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OUR FRESH-WATER ALGÆ.[1]

BY EDWARD S. BURGESS.

WHAT do you mean by the Fresh-water Algæ? and what interest do you find in them? are the questions I find asked me. Go with me to the coast, if you would learn my answer. Notice the sea-weed growing along the shore; see the dark olives and browns shown in the rockweed, left dripping and slippery by the retiring tide; note the waving tufts of green laver and sheets of membrane-like sea-lettuce floating near the tide-mark, and watch the beautiful red mossy cushions of delicate growth washed in by the breaking wave. Ask of almost any dweller on the coast and he will say, "People nowadays call them algæ." The longer you watch them the more attracted by their beauty you will become; soon you will begin to collect and mount them like other visitors to the shore. At first the most beautiful only will be collected; then others that are less so, "simply for the variety," as you may apologize to yourself; finally you will end by determining to keep a specimen of every kind, whether beautiful or not. And now you approach the stand-point of science, for science sees interest in every representative of a race, whether that race be high or low; and finds in every plant a right to our regard in the fact of its inheritance of the mystery of life.

But every summer must have its end, and so there will come the time of packing up the glowing specimens with their endless shades

[1] Condensed from a lecture delivered at the United States National Museum, Washington, D. C., January 7, 1888.

of reds and greens and olives. With the return to the interior the desire rises to expression, "Would that the inland waters contained such treasures as these mosses of the sea!" It is the old story, the wish is father to the thought, and the thought will perchance come to you, that perhaps they do; why should there not be mosses in the lake and river, brook and clear spring, as well as in the brine? and you resolve to look for yourself on your return, or you ask some one who knows to tell you if there are not also algæ in the inland waters. "Yes, certainly," he replies, and you then inquire, "Why is it then that I have never seen them?" to be reminded in turn that it is not the first time the eye has been awakened to perception of the beauties round its home by travels in a foreign land. Besides, the algæ of fresh-water are smaller and less conspicuous than those of the sea; many are microscopic, and many others are, when taken singly, but just visible to the naked eye. They are less varied in color as well, and so it has happened that many collectors know the sea mosses first, and if knowledge of the algæ of fresh water comes at all, it comes as a derivative from the other.

To compare the actual organs of the alga and the flowering plant, we remember that the flowering plant is adapted to land-conditions, securing nourishment from the air by its leaves and from the soil by its roots. The alga is adapted instead to water conditions and has no leaves nor roots for procuring nourishment, but absorbs through its general surface. The alga may or may not have root-like bodies (rhizoids), or a root-like base (a disc or hold-fast), but if present, these are simply to fix the plant in position. Presence of distinct stem and branches is optional with either. Most flowering-plants produce leaves; most alga do not; those leaf-like bodies which are produced, as by the Sargassum or Gulf-weed, are called phylloids; these do not occur in the strictly fresh-water species. As its name indicates, the flowering-plant is to produce flowers, and from them seeds containing an embryo of one or more seed-leaves (cotyledons). Alga produce no flowers and seeds, but instead, as a usual rule, spores. Their spores resemble seeds in appearance and in function, but contain no embryo and differ in details of development. The alga is thus the less specialized, the more simple, the lower in the scale of creation. Instead of delegating the functions of plant-life to separate portions of itself as

organs, the alga often combines them all in a single cell or ultimate constituent. In cases where the alga is composed of many cells the same principle often holds good, each cell being sufficient unto itself, uniting within its own small limits all the multifarious employments or functions which make up the life-activity of its species, and therefore able to live equally well if by accident it becomes detached from its associated cells. Hard-working cells are these, for they have not yet learned the rudiments of the division of labor; cells of manifold activities certainly, and correspondingly hardy, self-dependent, and ever unsubdued. They live and replenish the earth unseen by man, till by effects or masses of individuals they move him to wonder, and, as in the middle ages, to ascribe their sudden-seeming presence to the wrath of heaven or the agencies of the black art or to the medium of alchemy.

The present needs will not permit my entering into the subject of the scientific classification of the algæ, but it may be of service to notice some of the principal groups for which common names are in use. According to habitat we may divide all algæ into the marine and fresh-water divisions, including with the latter the ærial species, surface-dwellers on moist earth, sand, rocks and trees. Recombining all the algæ, they may be again divided according to coloring matter, contained, generally as a liquid, in their cells, classing them therefore as the red, olive and green algæ, and fourthly as the Phycochroms, the last having as their characteristic a bluish cast seen in the green, ashen or grayish hue which pervades them. The red algæ, so prized by collectors on the shore, are scantily represented in our inland waters; the olive do not appear at all; but the two other divisions find in fresh-water their chief representation. The green algæ of the tide-marshes along the coast are very conspicuous, and of uncounted numbers, but of very few species comparatively; those of fresh-water are probably still more abundant in individuals, certainly in species. The Phycochroms never reach as great a size as do members of each of the other sections; they are, indeed, chiefly microscopic, as individuals, if not as masses or colonies. Their cell-contents are also less highly organized. Their chief abode is in slowly running streams and quiet waters. They are the Cyanophyceæ of Goebel and of various authors since Nägeli, in 1849. They are remarkable for the pres-

ence of a beautiful blue coloring matter, phycocyan; and for the fact that no sexual modes of propagation have been discovered in them; nor, at least with rare exceptions, is there any evident nucleus, or central denser protoplasmic body, in their cells, such as is the rule elsewhere among plants.

Multiplication in the algæ takes place in either of several ways; the most common is that of fission, as in the multiplication of cells in a flowering-plant, where each cell divides into two parts, each a perfect whole like its parent. The two parts gradually increase in size until they reach their full degree, then themselves divide again, and so on. They may or may not remain attached to each other. Another mode of algal multiplication is by budding (gemmation), where the bud-like protrusion which grows into a new cell remains usually attached to its parent. A modification of this, prolification, consists of numbers of new cells arising from the side or end of the old, as if intended to become a separate individual, but often long adhering to the other, as if an attached child unwilling to remove from its parent. Some algæ, as the Caulerpa, rely on this method for their chief mode of propagation, as do so many of the higher plants upon "spreading by the root" in place of production of seed.

Another curious modification of budding is common in the red algæ, the production of tetraspores, bodies which are formed by division of a cell into four equal parts, each of which becomes a spore, able to grow into a new plant, and thus analogous to the bulblets produced by tiger-lilies and some onions.

Other algæ are reproduced by sexual methods, producing spores in some part of the process. Among the most remarkable of these are the zoospores, small seed-like bodies, usually soft and oval, sometimes spherical, tipped with one, two or more waving threads (cilia), which lash the water and carry the spore onward in the current thus produced, sometimes with great velocity and sometimes for several hours. The cilia finally fall off and the zoospore comes to rest; and if favorable conditions have befallen it, it has effected a lodgement on some resisting substance, there to begin to lengthen, divide into cells, and grow into a new plant. During their motile stage these little spores seem like so many little green animalcules darting about; so indeed they were long thought to be; and their names still perpetuates this idea, the word zoospore meaning "animal-spore."

Another kind of spore, motionless, unlike the preceding, the zygospore or "yokespore," is produced only as the result of two cells uniting and fusing their contents, the confined mass becoming the zygospore. This process of coalescence, known technically as conjugation, occurs in the beautiful Desmids, algæ so distinct as to form a group by themselves and therefore not now to be entered upon. The process also occurs in the Spirogyras and their relatives common in conspicuous green masses in still waters, each mass composed of long threads tangled together which shine with silky lustre when taken out of the water giving them their English name of silkweeds. These spores are smooth or spiny, often studded with knobs or branching thorns; they have a thick, hard case, resisting the drouth of summer and the cold of winter, enabling them to await their proper time of growth in safety. The zoospores are liable to confusion with certain green infusoria among animalcules, the zygospores with certain similar unicellular algæ as species of Acanthococcus, now thought to have been often mistaken in this country for desmid zygospores.

A very curious kind of reproduction is that of the Vaucheria and its allies, the production of "oospores," which resemble zygospores in their resting-period and in their hard, shell-like case, but differ in formation. And if with Goebel we include the Charas among the algæ, we are presented by them with still another mode of reproduction, the formation of "nucules" or nutlets, dark or red, often strikingly handsome to the naked eye when abundant in their little clusters on the green feathery plant, each nucule surrounded by its little involucre and itself chased as if by chisel with a spiral line winding many times round it.

But perhaps the most complicated of algal systems of reproduction is that of the red algæ, to be observed in fresh water in the Batrachosperms, Lemaneas, etc. It may be called the cystocarpic system, its result being the formation of a fruit or cystocarp, filled with spores, often reminding one of the grains in a pomegranate or the seeds in a water-melon, and sometimes still more regular in arrangement. Remembering the sexual system as developed in flowering-plants requires, previous to the formation of seed, the presence of the stamen and the pistil, respectively the male and female elements; we look for their counterpart in these plants, and

find it in the presence respectively of antheridia and archegonia. In the violet batrachosperms of fresh water these organs are produced on separate individuals. The antheridia contain small motile bodies, antherozoids, analogous to the pollen contained in the anthers of flowering-plants, and to the spermatozoids of animal life. These antherozoids find their way upon the other plant to where a long hair-like tube (the trichogyne) opens, through which their fertilizing influence reaches the protoplasm mass in the bulbous base of the tube (the archegonium or carpogonium). The protoplasm on fertilization swells, divides, usually forms new cells around it, as if walling itself in, and then a series of new cells within, many of which become spores, the whole fruit so formed becoming as full of spores as a stramonium pod of seeds, and generally resembling the latter in their position as well.

There is great variety of form among the algæ of fresh water, even among the unicellular species. It might be thought that these species, where the whole plant is composed of but a single cell, would present little variety; especially when it is considered that such simple cells commonly float loosely in the water, and in situations enabling the supposed normal spheroidal cell-form to develop itself, free from the influences of crowding or lateral stimuli. But not so simple is the plan of nature, and a great range of shape exists among the single-celled algæ, from the spherical of the common protococcus of our trees and walls to the bur-like spiny Polyedrium. For instance, one Rhaphidium is crescent-shaped, another needle-shaped, another unicellular algæ is shaped somewhat like the letter S, another like a J, another a C. The Botrydium is balloon-shaped, the Chytridium often urn-shaped, others appear as little discs, others ellipses, others cubical or pentagonal. When associated in masses, pressure and the exigencies of growth change the shape of those naturally circular into irregular polygons. Some species of Ophiocytium grow into curious coils; some Polyedriums are exact triangles, others take the form of a Greek cross. Extend our view to the desmids and diatoms, which are also of the unicellular algæ of fresh-water, and the number of cut and fantastic forms which a plant of a single cell may present, becomes indefinitely increased.

The larger number of species of the fresh-water algæ are, however, of more than one cell. Of these multicellular algæ some grow

into discs, as Coleochæte, some expand into a leaf-like membrane, as Prasiola, or widen from hollow spheres and tubes into broad undulating sheets like the Tetrasporas, others grow in solid globular masses, as the Chætophoras, one species of which occurs in the form of little green balls like peas, and hangs on dry grasses and other supports in quiet pools in spring. Others of looser texture, expand into an indefinite and irregular mass which will crumble at a touch, or form a gelatinous stratum which slips like oil through fingers that endeavor in vain to raise it from the water. Many others become firmly adherent crests on rocks, especially under falling water. Most of the more beautiful species become filaments, usually formed of cells placed end to end, sometimes composed of several or many such filaments bound together, either branching or not, and attaining particularly fine development in the Batrachosperms, where the many branched and forking filaments are clad with radiating whorls of smaller branches, often in the most perfect regularity.

Very commonly gelatinous in substance, many of the larger species are too frail to bear lifting out of the water, and yet endure considerable stress of their native current without harm, swaying with graceful motion as becomes beings born to the water. As there are all degrees of consistency in jellies, so there are in algæ, from the tough jelly of a Prasiola, to the fluid jelly of a Tetraspora. Professor Wood named his genus Pagerogala, "frozen milk," from its seeming to float like white curds of clotted milk in a Pennsylvania spring. Some Draparnaldias may fairly be called succulent, others approach nearest of any of our algæ to the wiry character; the Lemanea is sometimes almost leathery; Spirogyras feel under the fingers like a lock of hair; some of the largest Confervæ are tough enough to support considerable weight, and have such strength of fibre that German ingenuity has tested their capability for textile use, and not only made mattress-stuffing and paper from them, but actually fabricated them into coarse trowsers, as if to show that the common phrase "clad in weeds" is not incapable of the most literal of fulfilments. Stranger still than any Confervæ, are the mailed knights among the algæ, the little diatoms, absolutely unyielding and encased in silex, like so many little glass boxes under the microscope all curiously chased and set with flashing points and knobs. Some of

the Charas secrete instead of silica, a sheath of carbonate of lime about themselves, until the whole plant seems a succession of joints of stone, or links of white lime, giving it its popular cognomen of stonewort.

The colors of our fresh-water algæ are varied to a degree that may surprise the student who expects only green. There is considerable variety even in their green, from the usual grass-green of the Spirogyras to the pea-green of some Palmellas ; the little "water-flower," so to render its name, *Anabæna flos-aquæ*, is a verdigris-green ; *Chlamydomonas hyalina* is called by Wolle a milky-green. Many shades of red are found, vermilion in Chlamydococcus, scarlet in Thorea, blood-red in *Glœocapsa sanguinea*, amethystine in *Leptothrix tinctoria;* Hildenbrandtia is often purple, one of the Chantransias is rose-purple, a Lemanea is violet ; species of *Chroölepus* range through ash, yellow and orange to golden-red ; Tuomeya is said to be olive-colored, Hydrurus ochre ; some Vaucherias are brown, one Glœocapsa is black ; a Leptothrix is straw-colored, another fawn, a Chantransia steel-blue, a Cylindrocapsa pearly. Many preserve their color when dried ; others change, some simply by fading to a lighter shade of their previous color, others to a new tint ; one Batrachosperm is described as at first of a mouse-gray color, then yellow, and on drying, violet ; *Chantransia macrospora* and Thorea are, when living, dark green, but dry a beautiful purple-violet ; the Sweet Chroolepus is tawny when fresh, changes to an ashen-gray and finally greenish ; a kindred species is reddish-orange when olive, light yellow on drying ; *Zygnema purpureum* changes from yellowish-green to dark purple ; *Lyngbya tinctoria*, says Wolle, from purple to violet steel ; *Vaucheria dichotoma* may stand as type of the change so frequent in the higher plants, from green to brown. Many algæ unite several colors at the same time ; almost all do so when we compare the spores with the vegetative growth ; a remarkable instance of variegation in vegetable growth alone is seen in a new Lyngbya found by Wolle in the Lehigh at Bethlehem, Pennsylvania, waving in tufts six inches long, "the extremities bright-blue green, lower parts changing to yellow-brown ; and at last fading out to a colorless base."

Few of the odors possessed by the algæ have received a name. Out of the 1300 species recorded in this country by the Rev.

Francis Wolle, there is perhaps but one which has an odor remarkably offensive: this, the Hydrurus is, however, so unpleasant that the Dane Lyngbye remarked of it seventy years ago that "it could be endured only by an algologist." Bory called attention early in this century to "the most peculiar odor" of Lemanea when burned. Extend the view to the Charas, and to the diatom Schizonema, and a number of species of imitating or unpleasant odors are met; but the number of algæ which are in themselves possessed of much odor of any kind is few. If any persons associate disagreeable odors with the algæ, it is doubtless from confusing the odor of a place with that of an alga happening to be at the time its resident. Nor are the algæ without examples of exquisite fragrance; man might not have thought to look here for the sweetest odor, but Nature has not forgotten to add that charm to some of these, her lowly children; one of them *Chroölepus odoratus*, has been known in Denmark for over seventy years as the "sweet conferva"; it grows also on the bark of shade trees along highways in Pennsylvania. Perhaps more interesting still is the fragrance of the violet-moss, *Chroölepus iolithus*, which attracted the attention of Linnæus almost a century and a half ago; it grows as a thin glaucous, green or reddish-orange layer over stones in the Alps and in our own country in the White Mountains, causing them to "give forth a strong odor of violets." The Swiss are said to carry these stones home and by occasional moistening, to renew the odor from time to time. These Alpine people call it "Veilchen-moos" and the "Veilchen-stein"; and this latter was adopted as its name in science by Linnæus, for the specific name he gave it and which it still bears, is to be translated *Violet-stone*.

The size of our fresh-water algæ has been already referred to as commonly microscopic; yet there are many of considerable dimensions. About Washington we have Tetrasporas growing a foot long, beautiful undulating sheets of translucent green floating out on flowing water; some of our Cladophoras are still longer; and the sac-like Water-nets and the string-like Confervæ equal or exceed them. Any locality may yield however, for one specimen of six inches, a score of but one inch, and for each of the latter, an equally increased proportion on or below the border-line of vision.

Many minute algæ become very conspicuous by reason of their

immense numbers however; sometimes the whole surface of a lake is covered with them. For several years a little pond near Washington attracted my notice by its uniform dingy green; examination by the microscope proved regularly that it was due to presence of myriads of a very minute alga, a Staurastrum, a pretty little desmid with six radiating points of green. The Bavarian lake, the Schliersee, grew turbid under the ice of the winter before the present, acquiring a general green or blue, due, suggests Dr. Harz, to enormous quantities of the microscopic alga *Palmella uvæformis:* then the color changed under the ice to a yellow-red and at last to peach-color from the incoming of another alga, *Clathrocystis roseo-persicina*, which is said to have attacked and destroyed the other. This fittest survivor, conqueror in the battle of the algal hosts under the ice, was found lurking in wide expanses of beautiful peach color on the mud bottom of Babcock Lake here in Washington, recently drained to assure the safety of the Washington monument. The green surfaces of stagnant pools everywhere familiar, are also examples of minute algæ occurring in vast masses.

The larger species may be mounted on cards or sheets of unglazed paper as is so common with the marine algæ; or on sheets of mica for coarser microscopic examination; or preserved for the same purpose in bottles of carbolized water. My practice is, however, to preserve specimens for the microscope, large or small, in cement cells, using as a medium King's fresh-water algæ fluid; specimens of three or four years' standing still remain unchanged. Some species may be collected throughout the year, even under the ice; in the city of Washington many are constantly abundant as green coatings on trees, walls and stone steps; others live in the drinking fountains, species, as *Draparnaldia plumosa*, which exist only in pure water; others are to be sought on the damp wood work of pumps; still others in the conservatories, on damp bricks and flower-pots and in the soil. The mud of the Potomac margin contains its own species, and there the Vaucheria waves in profusion; Oscillarias, Palmellas, and other unicellular species abound; and outside of the city, springs, streams and pools are each full of their treasures, wet banks and even meadows yield their own peculiar species; and the early spring pools filled by Potomac overflows are especially the haunt of the Algæ.

And now if interest has been awakened in these minutest of the pet nurslings of nature, the next step is to collect, examine and preserve them. Do not stop at that point let me beg of you, for it is but the threshold; but seek to discover the entire life-history of the species around you. Uncounted problems of supremest interest await the verdict of those researches. Only by such work can the foundation of a true and permanent classification of the algæ be laid. Questions of far-reading importance follow regarding their relations to the fungi, and to animal life, and their ultimate part in the scale of nature. Uses the algæ may have, many and as yet unknown; but perhaps none more important will ever be discovered than their service which science already knows, that of furnishing a means by which to learn of the origin and the processes of life. The algæ as among the simplest of living things stand close to the gateway whence life first entered into the world, and invite the hope that their investigation may yield many important additions to the world's knowledge of what life is.

REVIEW OF THE PROGRESS OF NORTH AMERICAN PALÆONTOLOGY FOR THE YEAR 1887.

BY JOHN BELKNAP MARCOU.

I REGRET that, owing to the delay in the publication of the Smithsonian report for 1886, my record of North American palæontology for that year has not yet appeared, and the date of its publication is still uncertain. For this reason I again publish in the AMERICAN NATURALIST a brief review of the titles of the new works on North American palæontology, which I have collected during the year 1887, in order to give the workers in this branch of science a brief view of the work of the past year, leaving all abstracts, notes and comments to another paper, which will be published either by the Smithsonian Institution or the U. S. Geological Survey.

Truman H. Aldrich, in Jour. Cincinnati Soc. Nat. Hist., Vol.

X., No. 2, pp. 78–83, has "Notes on Tertiary Fossils, with Descriptions of New Species."

Henri M. Ami has an article "On the Occurrence of Scolithus in Rocks of the Chazy Formation about Ottawa, Ontario" in Canad. Rec. Sci., Vol. II., p. 304; on p. 429 he has one on "The Mica Formation in Canada"; in the Ottawa Naturalist, Vol. I., No. 9, p. 121, he has another, entitled "Notes on and the Precise Geological Horizon of *Siphonotreta scotia*"; with T. E. W. Sowter on p. 93, he publishes "Report on the Geological Branch."

L. W. Bailey, in Trans. Roy. Soc. Canada for 1886, Section IV., p. 35, has an article "On the Silurian System of Northern Maine, New Brunswick and Quebec."

G. Baur publishes in AMER. NATURALIST, Vol. XXI., p. 837, an article "On the Morphology and Origin of the Ichthyopterygia."

Chas. S. Beachler has an article on "Crinoid Beds at Crawfordsville, Indiana," in AMER. NATURALIST, Vol. XXI., p. 1106.

Chas. E. Beecher, in Thirty-ninth Ann. Rep. Trustees N. Y. Sta. Mus. Nat. Hist. for 1885, p. 161, has an article entitled "A Spiral Bivalve from the Waverly Group of Pennsylvania."

Walter R. Billings has "A New Genus and Three New Species of Crinoids from the Trenton Formation, with Notes on a large specimen of *Dendrocrinus proboscidiatus*" in the Ottawa Naturalist, Vol. I., No. 4, pp. 49–54.

J. P. Bishop, in Nature, Vol. XXXV., p. 237, has an article "On Certain Fossiliferous Limestones of Columbia County, New York, and their Relation to the Hudson River Shales and the Taconic System."

G. S. Boulger has an article "On the Connection in Time of Changes in Fossil Floras with those of Faunas" in Proc. Geol. Ass., Vol. IX., No. 7, p. 482.

C——— has "A Noteworthy Specimen of Devonian Lepidodendron" in Science, Vol. IX., No. 225, p. 516.

J. H. Chapin has "An Interesting Find" in Proc. and Trans. Merid. Sci. Assoc., Vol. II., p. 29.

Chapman, E. J., in Canad. Rec. Sci., Vol. II., p. 431, has an article "On the Classification of Trilobites."

J. M. Clarke publishes "Annelid Teeth from the Lower Portion

of the Hamilton Group and from the Naples Shales of Ontario County, N. Y.," and [Communication concerning Mastodon Bones found at Utica, Wyoming County, N. Y.], in Sixth Ann. Rep. N. Y. State Geologist for the year 1886, p. 30 and p. 34.

H. W. Conn has a review of "Cope's Origin of the Fittest" in AMER. NATURALIST, Vol. XXI., p. 465.

J. G. Cooper publishes "Corrections of Article 'On Fossil and Sub-Fossil Land Shells in the United States,' in Bull. No. 4," in Bull. California Acad. Sci., Vol. II., No. 7, p. 376, and "West Coast Pulmonata; Fossil and Living," in Bull. California Acad. Sci., Vol. II., No. 7, p. 355, and No. 8, p. 497.

E. D. Cope has in AMER. NATURALIST, Vol. XXI., p. 468, "American Triassic Rhyncocephalia; on page 1019 of the same journal he has "A Sabre-tooth Tiger from the Loup Ford Beds"; on page 171 of the same journal he has "Formations of the Belly River of Canada"; on page 924 of the same journal he has "Scott and Osborn on White River Mammalia"; on page 469 of the same journal he has "Some New Tæniodonta of the Puerco"; on page 367 of the same journal he has "The Dinosaurian Genus Cœlurus"; on page 566 of the same journal he has "The Marsupial Genus Chirox"; on page 445 of the same journal he has "The Mesozoic and Cænozoic Realms of the Interior of North America"; on pp. 985 and 1060 of the same journal he has "The Perissodactyla"; on page 573 of the same journal he has "The Sea-Saurians of the Fox Hills Cretaceous"; in Geol. Mag., New Ser., Sec. III., Vol. IV., p. 572, he has "Lydekker, Boulanger and Dollo on Fossil Tortoises"; in Proc. Amer. Phil. Soc., Vol. XXIII., p. 234, he has an article "On the Structure of the Brain and Auditory Apparatus of a Theromorphous Reptile of the Permian Epoch"; in the same journal, p. 357, he has "On Two New Species of Three-toed Horses from the Upper Miocene, with Notes on the Fauna of the Ticholeptus Beds"; on p. 146 of the same journal he has "Report on the Coal Deposits near Zacualtipan, in the State of Hidalgo, Mexico."

T. Nelson Dale has an article "On 'New England Upper Silurian'" in Proc. Canad. Inst., Third Ser., Vol. IV., Fasc. No. 1, p. 69.

William H. Dall, in Amer. Jour. Sci., Third Ser., Vol. XXIV., publishes "Notes on the Geology of Florida."

C. H. S. Davis has "The *Catopterus gracilis*" in the Proc. and Trans. Merid. Sci. Assoc., Vol. II., p. 19.

Dawson, George M., in Geol. and Nat. Hist. Survey of Canada, p. 1, has "Notes to accompany a Geological Map of the Dominion of Canada, East of the Rocky Mountains."

Dawson, Sir J. Wm., has an article "On Canadian Examples of Supposed Fossil Algæ" in Rep. British A. A. A. S., 1886, Birmingham Meeting, p. 651; in Canad. Rec. Sci., Vol. II., p. 404, he has an article "On the Correlation of the Geological Structure of the Maritime Provinces of Canada"; in same, p. 499, he has "Notes on Fossil Woods from the Western Territories of Canada"; he has, in Nature, Vol. XXXVI., p. 574, an article "On New Facts relating to Eozoon Canadense"; in Trans. Roy. Soc. Canada for 1886, Section IV., p. 1, he has "Presidential Address: Some Points in which American Geologic Science is indebted to Canada"; in same, p. 19, he has an article "On the Fossil Plants of the Laramie Formation of Canada."

Drummond, A. T., in Canad. Rec. Sci., Vol. II., p. 412, has an article on "The Distribution and Physical and Post-Geological Relations of British North American Plants."

P. Martin Duncan has an article "On a New Genus of Madreporaria—Glyphastræa, with Remarks on the Glyphastræa Forbesi, Edw. and H., sp. from the Tertiaries of Maryland, U. S.," in Geol. Mag., New Ser., Dec. III., Vol. IV., p. 43; in Quart. Jour. Geol. Soc., Vol. XLIII., p. 24, he has an article "On a New Genus of Madreporaria (Glyphastræa), with Remarks on the Morphology of Glyphastræa Forbesi, Ed. and H., from the Tertiaries of Maryland, U. S."; in Am. and Mag. Nat. Hist., Ser. 5, Vol. XIX., p. 260, he has "A Reply to Dr. J. G. Hinde's Communication 'On the Genus Hindia Dunc., and the Name of its Typical Species.'"

William B. Dwight publishes "Primordial Rocks of the Wappinger Valley Limestones" in Vassar Bros. Inst. Trans., Vol. IV., p. 130; in same, p. 206, he has "Primordial Rocks of the Wappinger Valley Limestones and Associate Strata"; in AMER. NATURALIST, Vol. XXI., p. 270, he has "Palæontological Observations on the Taconic Limestones of Canaan, Columbia County, N. Y."; and in Amer. Jour. Sci., Third Ser., Vol. XXXIV., p. 27, he has "Recent Explorations in the Wappinger Valley Limestone of Dutchess County, N. Y."

R. Etheridge and P. H. Carpenter publish "A Catalogue of the Blastoidea in the Geological Department of the British Museum of Natural History" in AMER. NATURALIST, Vol. XXXI., p. 68.

A. F. Foerste publishes in Bull. Sci. Laboratories Denison University, p. 71, "Coal-Measure Bryozoa from Flint Ridge"; in same, p. 89, he has "The Clinton Group of Ohio," Part II.; in same, p. 149, he has "The Clinton Group of Ohio," Part III.; and in Science, Vol. X., No. 248, p. 225, he has "Recent Methods in the Study of Bryozoa."

A. H. Foord, in Geol. Mag., New Ser., Dec. III., Vol. IV., p. 541, has an article "On the Genus Piloceras Salter, as Elucidated by Examples lately discovered in North America and in Scotland."

Persifor Frazer has "General Notes—Sketch of the Geology of York County, Pennsylvania," in Proc. Amer. Philos. Soc., Vol. XXIII., p. 391.

J. S. Gardner, in Geol. Mag., New Ser., Dec. III., Vol. IV., p. 158, has "The Appearance and Development of Dicotyledons in Time"; in Proc. Geol. Ass., Vol. IX., No. 6, p. 433, he has "Fossil Grasses."

Herbert Goss has an article "On Some Recently Discovered Insecta from Carboniferous and Silurian Rocks" in Proc. Geol. Ass., Vol. IX., No. 3, p. 131.

L. P. Gratacap, in Proc. Nat. Sci. Ass. of Staten Island, Extra No. 6, March, 1887, has "Preliminary List of Palæozoic Fossils found in the Drift of Staten Island"; in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 374, he has "The Eozoonal Rock of Manhattan Island."

James Hall publishes "Appendix A. Catalogue of Translucent Sections of Rocks and Fossils" in Thirty-seventh Ann. Rep. N. Y. State Mus. Nat. Hist."; in Sixth Ann. Rep. State Geologist for the Year 1886, p. 41, he has "Descriptions of Fenestellidæ of the Hamilton Group of New York"; publishes Fifth Annual Report of the State Geologist for the Year 1885; accompanied by a Geological Map of the State. Transmitted to the Legislature February 16, 1886. Albany: Weed, Parsons and Company, Printers, 1886, pp. 1–47, Plates XXVIII.; James Hall and George B. Simpson publish Geological Survey of the State of New York. Palæontology: Vol. VI. Corals and Bryozoa. Text and Plates. Con-

taining Descriptions and Figures of Species from the Lower Helderberg, Upper Helderberg and Hamilton Groups. Albany, N. Y.: Charles Van Benthuysen & Sons, 1887, 4to, pp. I.–XXVI. and 1–298. Pls. I.–LXVI. Errata 1 lf.; James Hall publishes Geological Survey of the State of New York. Palæontology: Vol. V., Part I. Lamellibranchiata II Text and Plates. Containing Descriptions and Figures of the Dimyaria of the Upper Helderberg, Hamilton, Portage and Chemung Groups. Albany, N. Y: Charles Van Benthuysen & Sons, 1885, 4to, pp. I.–LXII. and 269–561. Pls. XXXIV.–XCVI.; publishes "Note on Some Obscure Organisms in the Roofing Slates of Washington County, New York" in Thirty-ninth Ann. Rep. Trustees Sta. Mus. Nat. Hist. for 1885, p. 160; he has "Note on the Discovery of a Skeleton of an Elk ("*Elaphus canadensis*") in the town of Farmington, Ontario County" in Sixth Ann. Rep. State Geologist for the Year 1886, p. 39; he has "Note on the Occurrence of the Dictyospongidæ in the State of New York" in Sixth Ann. Rep. State Geologist for the Year 1886, p. 36; he has "Report of the State Geologist" in Thirty-ninth Ann. Rep. Trustees Sta. Mus. Nat. Hist. for 1885, p. 226.

Angelo Heilprin has "Additions to the Floridian Fauna" in Trans. Wagner Free Institute of Science, Vol. I., p. 129; he publishes "Determination of the Age of Rock Deposits" in Proc. Acad. Nat. Sci. Phila., Part III., p. 395; in same, p. 314, he publishes "The Classification of the Post-Cretaceous Deposits"; he publishes "The Geographical and Geological Distribution of Animals" in the International Scientific Series, p. 1.

C. L. Herrick publishes "Additional Fossils from Coal-Measures at Flint Ridge" in Bull. Sci. Laboratories Denison University, Vol. II., Parts I. and II., p. 144; in same, p. 51, he has "Appendix I. Notes on Carboniferous Trilobites"; on page 69 he has "Appendix II. A Waverly Trilobite. A Sketch of the Geological History of Licking Co., Ohio, accompanying an Illustrated Catalogue of Coal-Measure Fossils from Flint Ridge"; in same, on p. 5, he has "A Sketch of the Geological History of Licking Co., Ohio, accompanying an Illustrated Catalogue of Coal-Measure Fossils from Flint Ridge."

Henry Hicks, in Geol. Mag., New Ser., Dec. III., Vol. IV., p. 155, has "The Cambrian Rocks of North America."

E. W. Hilgard publishes "The Equivalence in Time of American Marine and Intracontinental Tertiaries" in Science, Vol. IX. No. 226, p. 535.

Robert T. Hill publishes "The Cross Timbers of Texas" in AMER. NATURALIST, Vol. XXI., p. 172; in Amer. Jour. Sci., Third Ser., Vol. XXIV., p. 287, he publishes "The Texas Section of the American Cretaceous"; in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 291, he publishes "The Topography and Geology of the Cross Timbers and Surrounding Regions in Northern Texas."

G. J. Hinde publishes "Die Versteinerungen des cambrischen Schichtensystems der Insel Sardinien, nebst vergleichenden Unterschungen über analoge Varlomnisse aus andern Ländern" in Geol. Mag., New Ser., Dec. III., Vol. IV., p. 226; in Ann. and Mag. Nat. Hist., Ser. 5, Vol. XIX., p. 67.

Fanny A. M. Hitchcock, in AMER. NATURALIST, Vol. XXI., p. 847, has an article "On the Homologies of Edestus."

Rev. D. Honeyman has "A Revision of the Geology of Antigonish County, in Nova Scotia" in Proc. and Trans. Nova Scotian Inst. Nat. Sci., 1883–6, Vol. VI., p. 308.

O. P. Hubbard has "Skeleton of a Whale found over 130 years since in the St. Lawrence River Valley near Quebec" in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 242.

Alpheus Hyatt has an article "On Primitive Forms of Cephalopods" in AMER. NATURALIST, Vol. XXI., p. 64; and in Proc. Boston Soc. Nat. Hist., Vol. XXIII., p. 315, he has "Expedition [to Newfoundland and Labrador]."

Joseph F. James publishes in Jour. Cincinnati Soc. Nat. Hist., Vol. X., No. 2, p. 70, "Account of a Well Drilled for Oil or Gas at Oxford, Ohio, May and June, 1887"; in Science, Vol. X., No. 250, p. 252, he has "Microscopic Sections of Corals"; in same, Vol. X., No. 242, p. 156, he has "Chalcedonized Fossils"; in Jour. Cincinnati Soc. Nat. Hist., Vol. IX., No. 4, p. 244, he has "Protozoa of the Cincinnati Group"; in Science, Vol. X., No. 244, p. 180, he has "Sections of Fossils."

U. P. James and Joseph F. James publish an article "On the Monticuliporoid Corals of the Cincinnati Group, with a Critical Revision of the Species," in Jour. Cincinnati Soc. Nat. Hist., Vol. X., No. 3, p. 118.

U. P. James has "Genus Agelacrinus Vanuxem, Agelacrinus holbrooki," in Jour. Cincinnati Soc. Nat. Hist., Vol. X., No. 1, p. 25.

George F. Kunz has "Jasperized and Agatized Wood from Arizona" in Trans. N. Y. Acad. Sci., Vol. VI., p. 165.

L'Abbé J. C. Laflamme has "Note sur le contact des formations paleozoïques et archéennes de la province de Quebec" (Lu le 28 Mai, 1886) in Trans. Roy. Soc. Canada for 1886, Section IV., p. 43.

Chas. Lapworth publishes "Fossils from Kicking Horse Pass, Manitoba," in Science, Vol. IX., No. 217, p. 230; also, "Preliminary Report on Some Graptolites from the Lower Palæozoic Rocks on the South Side of the St. Lawrence from Cape Rosier to Tartigo River, from the North Shore of the Island of Orleans, one mile above Cape Rouge, and from the Cave Fields, Quebec," in Trans. Roy. Soc. Canada for 1886, Section IV., p. 167.

Joseph Leidy has "Fossil Bones from Florida" in Proc. Acad. Nat. Sci. Phila., Part III., p. 309.

A. T. Lilley publishes "A Revision of the Section of Chemung Rocks exposed in the Gulf Broad Gorge, at Le Roy, in Bradford Co., Pennsylvania," in Proc. Amer. Phil. Soc., Vol. XXIII., p. 291.

A. P. Law has "Preliminary Report on an Exploration of Country between Lake Winnipeg and Hudson Bay" in Part F. Annual Report, 1886, Geological and Natural History Survey of Canada, p. 1.

Richard Lydekker has an article on "The Order Ungulata, Suborder Proboscidea," in Catalogue of the Fossil Mammalia in the British Museum (Natural History), p. 1.

A. McCharles has "The Footsteps of Time in the Red River Valley, with Special Reference to the Salt Springs and Flaming Wells to be Found in it," in the Hist. and Sci. Soc. of Manitoba Trans., No. 27, Season, 1886–7, p. 1; in Trans. Geol. Soc. Edinburgh, Vol. V., Part II., p. 331, he has "Notes on the Geology of the Winnipeg District, Manitoba."

R. G. McConnel, in Part D, Annual Report, 1886, Geological and Natural History Survey of Canada, p. 1, has "Report on the Geological Structure of a Portion of the Rocky Mountains, accompanied by a Section measured near the 51st Parallel."

W. J. McGee has an article on "*Ovibos cavifrons* from the Loess of Iowa" in Amer. Jour. Sci., Third Ser., Vol. XXXIV., p. 217.

J. B. Marcou has "Review of the Progress of North American Palæontology for the Year 1886" in AMER. NATURALIST, Vol. XXI., p. 532.

Jules Marcou has an article "On the Use of the Name Taconic" in Proc. Boston Soc. Nat. Hist., Vol. XXIII., p. 343.

O. C. Marsh has "American Jurassic Mammals" in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 327; in same, Vol. XXXIV., Append. p. 324, he has "Notice of New Fossil Mammals"; in same, page 412, he has "Principal Characters of American Jurassic Dinosaurs. Part IX. The Skull and Dermal Armor of Stegosaurus."

G. F. Matthew has "A Preliminary Notice of a New Genus of Silurian Fishes" in Bull. Nat. Hist. Soc. New Brunswick, No. 6, p. 69; in Canad. Rec. Sci., Vol. II., p. 323, he has "Additional Note on the Pteraspidian Fish found in New Brunswick"; in same, p. 357, he has an article "On the Smaller-eyed Trilobites of Division I., with a few Remarks on the Species of the Higher Divisions of the Group"; in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 388, he has "The Great Acadian Paradoxides"; in same, p. 390, he has an article "On the Kin of Paradoxides (Olenellus) Kjerulfi"; in Canad. Rec. Sci., Vol. II., p. 432, he has "Illustrations of the Fauna of the St. John Group. No. IV. On the Smaller-eyed Trilobites of Division I., with a few Remarks on the Higher Divisions of the Group"; in same, p. 434, he has "Illustrations of the Fauna of the St. John Group. No. 5. On the Great Acadian Trilobite, Paradoxides Regina"; in Trans. Roy. Soc. Canada for 1886, Section IV., p. 147, he has an article "On the Cambrian Faunas of Cape Breton and Newfoundland."

F. J. H. Merrill has "Note on the Green Pond Mountain Group of New Jersey" in Trans. N. Y. Acad. Sci., Vol. VI., p. 59.

Otto Meyer has an article "On Invertebrates from the Eocene of Mississippi and Alabama" in Proc. Acad. Nat. Sci. Phila., Part I., p. 51; he has "Beitrag zur Kentniss der Fauna des Altertteriärs von Mississippi und Alabama" in Bericht über die Senckenbergische naturfanschende Gesellschaft in Frankfurt am Main, 1887. Vorägert und Abhandlungen, pp. 1–22, pls. I.–II. Farnkfur a. Mt.

L. C. Miall and Alfred Denny have "The Structure and Life history of the Cockroach (*Periplaneta orientalis*), an Introduction, to the Study of Insects" in Ann. and Mag Nat. Hist., Ser. 5, Vol. XIX., p. 389.

David R. Moore has "Fossil Corals of Franklin County, Indiana" in Bull. Brookville Soc. Nat. Hist., No. 2, p. 50.

Frank L. Nason, in Am. Jour. Sci., Third Ser., Vol. XXXIV., p. 485, has an article "On the Location of Some Vertebrate Fossil Beds in Honduras, C. A."

J. S. Newberry has "The Fauna and Flora of the Trias of New Jersey and the Connecticut Valley" in Trans. N. Y. Acad. Sci. Vol. VI., p. 124; in same, p. 137, he has "Cœlosteus, a new Genus of Fishes from the Lower Carboniferous Limestone of Illinois"; in same, p. 164, he has "Description of a New Species of Titanichthys."

H. Alleyne Nicholson has, in Ann. and Mag. Nat. Hist., Ser. 5, Vol. XIX., p. 1, an article "On Some New or Imperfectly Known Species of Stromatoporoids. Part III."

Henry F. Osborn has "A Pineal Eye in the Mesozoic Mammalia" in Science, Vol. IX., No. 208, p. 92; in same, No. 209, p. 114, he has "The Pineal Eye in Tritylodon"; in same, No. 226, p. 538, he has "No Parietal Foramen in Tritylodon"; in Proc. Acad. Nat. Sci. Phila., Part II., p. 282, he has an article "On the Structure and Classification of the Mesozoic Mammalia"; in AMER. NATURALIST, Vol. XXI., p. 1020, he has "Note upon the Genus Anthrodon"; in Science, Vol. X., No. 254, p. 300,

Richard Owen has "American Evidences of Eocene Mammals of the 'Plastic Clay' Period" in Rep. British A. A. A. S, 1886, Aberdeen Meeting, p. 1033.

A. S. Packard has "Discovery of the Thoracic Feet in a Carboniferous Phyllocaridan" in Proc. Amer. Phil. Soc., Vol. XXIII., p. 380; in AMER. NATURALIST, Vol. XXI., p. 1100, he has "Fossil Arthropods"; in Nat. Acad. Sci., Vol. III., Fifteenth Mem., p. 135, he has an article "On the Anthracaridæ, a Family of Carboniferous Macrurous Decapod Crustacea"; in same, Sixteenth Mem., p. 143, he has an article "On the Carboniferous Xiphosurous Fauna of North America"; in Ann. and Mag. Nat. Hist., Ser. 5, Vol. XIX., p. 164, he has an article "On the Class Podostomata,

a Group embracing the Marostomata and Tribolites"; in Nat. Acad. Sci., Vol. III., Fifteenth Mem., p. 129, he has "On the Gampsonychidæ, an Undescribed Family of Schizopod Crustacea"; in same, p. 123, he has "On the Syncarida, a hitherto Undescribed Synthetic Group of Extinct Malacostracous Crustacea."

Marie Pavlow has an article entitled "Etudes sur l'Histoire Paléontologique des Ongulés en Amérique et en Europe 1 Groupe primitif de l'éocène inférieur" in Bull. Soc. Imp. des Nats. de Moscou Année 1887, No. 2, p. 343.

Charles S. Prosser, in Proc. Amer. Ass. Adv. Sci., Vol. XXXVI., p. 216, has "The Upper Hamilton of Chenango and Otsego Counties, New York.

Ferd. Rœmer has "Ueber H. v. Meyer's Mastodon Humboldti Cuv. aus Mexico" in Neu. Jahrb. für Min. Geol. & Pal., 1887, Band I., p. 114.

C. Rominger has "Description of a New Form of Bryozoa" in Proc. Acad. Nat. Sci. Phila., Part I., p. 11; in same, p. 12, he has "Description of Primordial Fossils from Mount Stephens, N. W. Territory of Canada."

Scott, W. B., and Osborn, H. F., have "Preliminary Account of the Fossil Mammals from the White River Formation contained in the Museum of Comparative Zoology" in Bull. Mus. Comparative Zool. Harvard College, Vol. XIII., No. 5, p. 151.

S. H. Scudder has "Fossil Insects" in Science, Suppl., Vol. IX., No. 221, p. 426.

H. P. Smith has "*Bison latifrons*" Leidy, in Journ. Cincinnati Soc. Nat. Hist, Vol. X., No. 1, p. 19.

L. v. Tausch has "Ueber die Beziehungen der Fauna der nicht marinen Kreidebildungen von Ajke im Bakony zu jener der Laramiebildungen Nord-Amerikas" in k. k. geol. Reich. Verhand, 1886, Nos. 7–18, p. 180–4, Vienna, 1886.

A. S. Tiffany, Rev. Dr. Barris, The Critic, Reviewed.

E. O. Ulrich has "Silurian and Devonian Fossils" in AMER. NATURALIST, Vol. XXI., p. 69, January, 1887.

Carl Vogt has an article "On Some Darwinistic Heresies" in Ann. and Mag. Nat. Hist., Series 5, Vol. XIX., p. 57.

C. Wachsmuth and F. Springer, in Proc. Acad. Nat. Sci. Phila, Part I., p. 82, has "The Summit Plates in Blastoids, Crinoids and Cystids, and their Morphological Relations."

C. D. Walcott has "Fauna of the 'Upper Taconic' of Emmons, in Washington Co., N. Y., with Plate I." in Amer. Jour. Sci., 3d Ser., Vol. XXXIV., p. 187; in same, p. 145, he has "Note on the Genus Archeocyathus of Billings"; in same, Vol. XXXIII., p. 153, he has "The Taconic System."

L. F. Ward has "Synopsis of the Flora of the Laramie Group" in Dept. Int. U. S. Geol. Surv. Ann. Rept. Director, 1884–5, p. 405, pls. XXXI.–LXV."; in Bull. U. S. Geol. Surv., No. 37, p. 1, pls. I.–LVII., he has "Types of the Laramie Flora."

C. A. White has an article "On New Generic Forms of Cretaceous Mollusca and their Relation to other Forms" in Proc. Acad. Nat. Sci. Phila., Part I., p. 32, pl. II.; in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 18, he has one "On the Age of the Coal found in the Region traversed by the Rio Grande"; in Proc. and Nat. Sci. Phila., Part I., p. 39, he has one "On the Cretaceous Formations of Texas and their Relations to those of Other Portions of North America"; in Amer. Jour. Sci., Third Ser., Vol. XXXIII., p. 364, he has one "On the Inter-Relation of Contemporaneous Fossil Faunas and Floras."

J. F. Whiteaves has "Illustrations of the Fossil Fishes of the Devonian Rocks of Canada, Part I. (read May 27 and revised July 26, 1886)," in Trans. Roy. Soc. Canada for 1886, Section IV., p. 101.

R. P. Whitfield has "New New Jersey Cretaceous" in AMER. NATURALIST, Vol. XXI., p. 66.

S. G. Williams has "Note on the Lower Helderberg Rocks of Cayuga Lake (communicated to the Report of the State Geologist for 1886)" in Sixth Ann. Rep. State Geologist for the year 1886, p. 10, Albany, 1887; in same, p. 13, he has "The Tully Limestone, its Distribution and its Known Fossils."

L. R. Witherell has "Some Facts from the Age of Horns" in Jour. of Sci. and Art, Vol. I., No. 2, p. 323.

J. H. Wood has "Desiccated Bodies (5) from a cave in the Bad Lands of Dakota" in Science, Vol. IX., No. 213, p. 213.

A. S. Woodward has "The History of Fossil Crocodiles" in Proc. Geol. Ass., Vol. IX., February, 1886, No. 5, p. 288, London Univ. College, 1887.

H. Woodward, has an article "On 'Flightless Birds,' commonly

called 'Wingless Birds,' Fossil and Recent, and a Few Words on Birds as a Class," in Proc. Geol. Ass., Vol. IX., February, 1886, No. 5, p. 352, pls. I.–II., London Univ. College, 1887.

L. Woolman has "Geological Results of the Boring of an Artesian Well at Atlantic City, N. J.," in Proc. Acad. Nat. Sci. Phila., Part III., p. 339.

J. L. Wortman has an article "On the Teeth of the Vertebrata" in AMER. NATURALIST, Vol. XXI., p. 463.

J. Young has "Note on a New Family of the Polyzoa—Cystodictyonidæ (E. O. Ulrich)—with Notice of Three Carboniferous Species," in Trans. Edinburgh Geol. Soc., Vol. V., Part III., p. 461.

THE DIKES OF THE HUDSON RIVER HIGHLANDS.

BY J. F. KEMP.

THE cuts of the West Shore Railway, on the Hudson river, above Haverstraw, and below Cornwall, have done much service to geology in bringing to light the subsurface and unaltered structure of the Archæan rocks. The Stony Point cut did more than any other exposure to convince Professor J. D. Dana of the intrusive character of the now famous Cortlandt series.[1] It exhibits as well one of the most interesting examples of the contortion of mica schists on the contact with intrusive rocks which any known area affords. Here also Dr. Geo. H. Williams found the types of his hornblende-peridotite,[2] and was especially aided in his careful studies of the series. Beyond Stony Point the railway crosses the belt of blue limestone so extensively quarried at Tomkins' Cove, and then in the foot of the Dunderberg meets the main mass of the Highland Archæan. Through this it has made its way by cuts, excavations and tunneling a distance of seventeen miles to Cornwall, where it again passes off the Archæan.

[1] Am. Jour. Sci., III Series, vol. xxviii., p. 384.
[2] Ibid., vol. xxxi., p. 29.

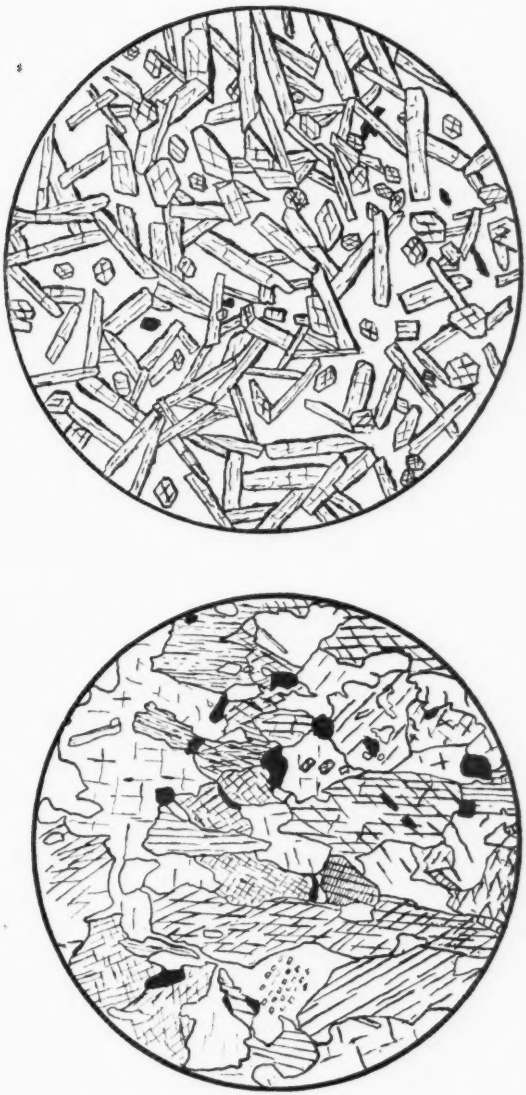
The reconnaissance survey of Dr. Britton[1] and Mr. Merrill over this line, in connection with the New Jersey survey in 1885, brought to light some, at first sight, rather obscure dike rocks which were entrusted to the writer for determination. Their interesting character, however, encouraged further investigation in the field by him the past summer, and this has led to the following results. In the October School of Mines Quarterly (Vol. IX., p. 33), Dr. Britton has outlined the results of his work. In brief he subdivides the Archæan into a basal "Massive Group," a middle "Iron-Bearing Group," and an upper "Gneissic and Schistose Group." These members, as remarked by Dr. Britton, shade more or less into one another, nor is it always easy to sharply define the individuals. In the particular section under consideration we have especially to deal with the iron-bearing and massive members as containing the dikes, for the area which is notable for their absence is regarded by Dr. Britton as belonging to the upper Gneissic and Schistose series.

Of the dikes between Tomkins' Cove and Jones' Point the writer is prevented by the unfortunate loss of a note-book from speaking with the same accuracy of location as in regard to those remaining. There are some present, though in but few instances. One slide shows a hornblende-porphyrite very similar to one found inland and about two miles west, to be described and figured in a paper forthcoming in the *American Journal of Science* for September. This is probably an outlying dike of the Cortlandt series.

From Jones' Point to Iona Island the railway skirts the Dunderberg. The rocks are gneisses, with evident laminations that strike on the average N. 40 E. Just above Jones' Point, and at intervals for two miles to the north, they are seamed with dikes. Eleven such masses were noted. They vary from six inches to twenty feet wide, and are in almost all instances very badly altered on the exposure. In fact they weather much worse than the enclosing walls, and frequently show a recess from which the specimen has to be fairly dug out. Under the microscope enough of the structure remains to show that they were in all cases either diorites or hornblende-porphyrites, consisting either of a holocrystalline aggregate of hornblende, plagioclase and magnetite, or of a ground mass now

[1] See Rept. State Geol. New Jersey, 1886, p. 74.

PLATE XII.



Section of Dyke-rock from the Highlands.

merely a structureless alteration product with occasional crystals of hornblende, plagioclase and magnetite. Pyrite is sometimes seen; the same is true of biotite and small prisms of apatite. The magnetite shows indications of titanium. The Dunderberg exposures are rather conspicuously contorted and broken. The strike of the laminations of the gneiss, while generally northeast, cannot in all cases be determined. The dikes seem sometimes parallel with them, sometimes notably run across them. They may or may not have experienced some or all of the metamorphic processes through which the wall rocks have passed (an idea to be more fully developed later), but the porphyritic structure would indicate the contrary. Much in the way of contact influences, if anything, cannot be detected. They are not far from the neighboring Cortlandt series. They may have been connected with it. This at present cannot be affirmed or denied.

North of the railway station at Iona Island, a belt of hornblendic schist, with great masses of hornblende and epidote, is encountered. This association is quite typical of certain localities in the Iron Bearing group, and strongly resembles the same association of the two minerals to be seen at the Todd[1] Mine in Sprout Brook Valley, northeast from Peekskill. This last is on the line of strike from Iona Island. It is not surprising, as the writer was informed by a resident, that explorations have been made in the southwest, finding, however, nothing but lean ore, too poor to work. These outcrops possibly form a "range" similar to the well-known ranges of New Jersey, with the Croft and Stuart or Sunk mines at the extreme northeast.

Between the Poplopen creek drawbridge and Fort Montgomery, is to be seen a bed of crystalline limestone or calcite, filled with rough crystalline inclusions of an undetermined mineral, probably pyroxene, and much graphite. This is in all respects similar to those noted by Dr. Horton further to the northwest,[2] although this particular outcrop seems not to have been observed by him.

At the north end of the first cut above Fort Montgomery is a very curious narrow dike of dense black rock, four inches wide, traceable twenty feet or more vertically. It runs diagonally across the laminations of the gneiss, and seems to fill a well-defined crack.

[1] Cf. Tenth Census, vol. xv., p. 90 ff.

[2] Geol. of N. Y., 1st Dist., p. 477.

Under the microscope it is seen to consist chiefly of innumerable small but well-developed hornblende crystals, having sharply defined prismatic and pinacoidal faces. They vary from 0.02 mm. to 0.05 mm. in width, and are about five times as long. The accompanying drawing (Fig. 1), from a micro-photograph, illustrates the structure. The actual field is one millimetre in diameter. With the hornblende is some plagioclase not very well developed, as the rock has more or less of a porphyritic facies. Magnetite is sparsely scattered through it in very small grains. Slides of this rock are well nigh indistinguishable from those of the diorite described by Hawes from Campton,[1] N. H., and later by Professor Harrington from Montreal, resembling[2] less closely the similar diorite described by the writer from the Forest of Dean mine.[3] Mr. L. M. Dennis, Instructor in Chemistry in Cornell University, has made the following analysis, No. 1 in duplicate. No. 2 is of the Campton dike by Hawes, No. 3 of the Montreal dike by Professor Harrington, No. 4 of the Forest of Dean by the writer.

	I.		II.	III.	IV.
	a.	b.			
SiO_2	44.85	44.87	41.94	40.95	48.19
Al_2O_3	17.20	17.281	15.36	16.45	16.79
Fe_2O_3	11.20	11.04	3.27	13.47	18.37
FeO	.....	.....	9.89	.....	.....
MnO	trace	trace	.25	.33	.....
TiO_2	6.578	6.738	4.15	3.39	.....
CaO	7.52	7.54	9.47	10.53	6.85
MgO	5.02	4.946	5.01	6.10	1.32
K_2O	2.992	2.621	.19	1.28	1.11
Na_2O	1.390	1.611	5.15	4.00	5.59
P_2O_5	.383	.447	.....	.29	.....
CO_2	.....	.....	2.47	.....	.....
Loss on ignition	2.387	2.491	3.29	3.84	2.31
Totals	99.520	99.585	100.44	100.63	100.53

The discovery of this rock is interesting as showing the further occurrence of dikes of this character. On the basis of Hawes' description, Rosenbusch has made a separate type of dike rocks,[4] and called them Camptonites. Various outcrops of so-called trap dikes are recorded by the New York Survey in other parts of

[1] Am. Jour. Sci. III., vol. xvii., p. 147.
[2] Geol. Survey Canada, 1877–78, p. 439.
[3] Am. Jour. III., vol. xxxv., p. 331.
[4] Rosenbusch. Mikros-Physiographie, 2d Edition, vol. i., p. 333.

Orange county, which may prove on further examination to be similar. The writer hopes, as opportunity occurs, to add to our knowledge of them.

Beyond Fort Montgomery, except in the case just cited, no dike rocks are to be seen until Cro' Nest Mountain is reached, north of West Point. The interval is made up of gneisses, very feldspathic, and considered by Dr. Britton to belong to the Upper Schistose Series. They have peculiar feldspathic masses in them which must be considered in any question of origin or metamorphic action. Great cleavage faces of feldspar as large as the hand reflect the sunlight from the sides of the cuts. Cro' Nest and Storm King form the northern boundary of the Highlands west of the Hudson. They consist of rocks which are described by Dr. Britton[1] as quartz-syenite, and are considered as typical of the massive group. The laminations are generally apparent, but in many instances the rocks present a well-nigh massive appearance. Running like broad black ribbons in directions generally vertical, across the exposed faces are numerous dikes varying in width from a few inches to forty feet. Fifteen were noted in Storm King, six in Cro' Nest.

These dikes are very uniformly holocrystalline aggregates of hornblende, augite and plagioclose as principal minerals, with subordinate magnetite and apatite, and occasionally a little biotite, orthoclase and quartz. The hornblende and augite are generally associated, but there are instances in which each appears alone with the other minerals mentioned. The augite appears alone especially in those dikes whose wall rock is most broken and contorted. The hornblende is of the common brown variety strongly pleochroic. It is never in well-bounded crystals, but always in irregular masses, whose external shapes are conditioned by their neighbors. It frequently contains included the apatite and magnetite, and the masses vary from 0.5 mm. to 1.0 mm. in width, but are relatively somewhat longer. In the more altered specimens the hornblende tends to bleach out to a green variety. The augite is in the same irregular masses of light green color, and contains the same inclusions, but on the whole is less prone to do so. The biotite is far less abundant than the two just men-

[1] The School of Mines Quarterly, vol. ix., p. 34.

tioned, contains, however, magnetite inclusions, but in other respects shows no peculiarities worthy of note. The feldspar is in irregular masses, well twined, and contains not unfrequently as inclusions the hornblende and augite, as well as magnetite and apatite. By powdering the rock and carefully separating the feldspar by means of the Thoulet's heavy solution the specific gravity was found to lie between 2.67 and 2.70, bringing it near Labradorite.[11] The magnetite is in coarse, irregular masses, showing no indications of titanium. The apatite prisms are also quite coarse. It follows, therefore, from the relations above set forth, that, according to the well-known general law,[12] the magnetite and apatite have been first to form, and have then been taken up in the mass of the hornblende, augite and biotite in their subsequent crystallization, while the feldspar has been last of all to form, as it includes all the others. In the accompanying figure (Fig. 2), taken from a microphotograph, the structure of a typical specimen is shown. The actual field is 4.0 mm. in diameter. The different minerals, hornblende, augite and plagioclase are well indicated by their characteristic cleavages.

In the matter of classification these rocks are perhaps most nearly allied to those called by Rosenbusch Camptonites,[13] but in the matter of structure it should be stated they differ widely from the typical Camptonites in the writer's possession, for anything like a porphyritic structure is entirely lacking. Although differing from the typical and widely-known kersantites in the small amount of biotite contained, they yet, with some described varieties,[14] seem structurally related. A normal kersantite has been described from this region by Dr. Newberry,[15] which seems to form a boss in the enclosing gneiss at Croton Point.

[1] Rosenbusch. Mikros-Phys. 2d Ed., vol. i., p. 535.

[2] Rosenbusch. Neues Jahrbuch f. Min., etc., 1882, II., p. 1-16.

[3] For a translation of Rosenbusch's scheme, see the Amer. Naturalist for March and April, 1888, p. 207, etc. It is much to be regretted that Professor Bayley did not translate in this connection the German word "gang" by our English equivalent "dike." The English word "vein" is now so well understood in all the literature on ore deposits to refer to a mineral body deposited from solution, that an intrusive or igneous vein seems a misnomer.

[4] Cf. Pohlmanns. 4th Group. Neues Jahrb. Beil. Band., III., 1884, p. 67.

[5] The School of Mines Quarterly, vol. viii., p. 330, July, 1887.

In some cases these dikes are parallel to the laminations of the enclosing gneiss or syenite, in other cases cut across them. Many would seem at first sight to be interbedded masses, and the writer would confess himself inclined at first to take the view that if these mountains are to be considered metamorphosed sediments, then these dikes represent strata of composition different from the remainder. There are, however, illustrations, as stated above, of unconformability, and not only that, but of two separated and unconformable branches joining above while separated below. (Spec. 32 and 33, two dikes each twelve feet wide just south of Cro' Nest flag station.) They are, therefore, esteemed of undoubted intrusive origin.

The dikes are not infrequently faulted by feldspathic segregations. In Storm King, above the paving stone quarry, six, from four inches to eighteen inches wide, are exposed, four of which are faulted by such a segregation. The inference from this is that the dikes are of great geological antiquity. These feldspathic masses consist chiefly of very coarsely crystalline orthoclase. Such a mass we know would form only under high pressure and great heat,[1] and indicates the changes through which these rocks have passed since the dikes were intruded. The geological date of the metamorphism, if such it were, which gave these syenites or gneisses their present form, it is not easy to state, but from the comparatively unchanged condition of the strata lying against them to the north at Cornwall, it must have been before the Hudson River Period of the Lower Silurian. In the writer's opinion the dikes were intruded in Archæan time, and have experienced the same influences which have given the gneisses their bedded character. It cannot be affirmed that the dikes themselves are metamorphosed from their original structure, but it is interesting to note that they exhibit even in their narrowest examples a perfect holocrystalline structure, nor is any amorphous or porphyritic matter to be detected. We infer from this either that they were intruded between highly heated walls, and that they cooled slowly and under pressure like a plutonic rock (Tiefengestein); or else that subsequent metamor-

[1] Hautefeuille, Comptes Rendus, 1877, t. lxxxv., p. 952, idem. t. xc., 1880, p. 830. Friedel et Sarasin, B. Soc. Min., 1879, p. 158, and 1881, p. 171.

phism has recrystallized any first formed porphyritic matter. The metamorphism of igneous or intrusive rocks is a subject now attracting much attention, and has important bearing on the origin of the Archæan.[1] As for explaining the slight bedding or laminations of the wall rocks by previous sedimentary stratification, while it is not easy to adduce any positive facts against it, the writer does not believe in it. It seems most reasonable to regard the laminations as due to pressure exerted normally to them, and that the pressure was in almost all cases normal to the dikes as well.

The origin of these well-nigh massive basal rocks of the Archæan is certainly at present a most uncertain theme. Yet, although it is readily to be seen from much that has been written how easy it is to indulge in laboratory speculations which afford little else than controversial material, the writer would nevertheless advance the conclusions drawn from the structure and composition of these dikes as legitimate if not incontrovertible inferences.

SCIENCE IN UTOPIA.

BY C. L. HERRICK.

IT has doubtless been a matter of regret to many of my readers that since the publication of the valuable memoirs of Sir Thomas Moore upon Utopia no one has succeeded in penetrating the veil of mystery hanging over those happy islands.

For my own part I have often amused myself by wondering whether egress is as difficult as access and in imagining a sort of espionage of modern institutions by that conservative and self-satisfied community.

Very unexpectedly my vagaries were suddenly proven realities and I am permitted to record the results of an extended conversation with a representative and very intelligent member of the recent scientific congress of Utopia.

[1] This has been strongly advocated by Lehmann. Entstehung der Altkrystallinen Schiefergesteine. Reviewed by D. Geo. H. Williams in Am. Jour. Sci. III., vol. xxviii., p. 392.

My present purpose is simply to repeat a few facts communicated by this gentleman which seemed to me well worthy of examination if not imitation by the learned bodies of our own land. For further details the reader is modestly referred to the illustrated memoir now in preparation under the joint superintendance of my Utopian friend and the author.

These remarks must, therefore, be simply regarded in the light of a preliminary notice (Vorläufige Mittheilung) for which, by the way, I am assured there is no synonym in Utopian language or praxis.

Mr. Non[1] Nemo himself is well worthy a passing glance. Though below the medium stature of Americans he possesses a perfection of physical development not seen in the intellectual classes of our own people. Upon my remarking upon this peculiarity so disassociated in our minds with a studious habit, Mr. Non Nemo explained that in Utopia a high degree of physical perfection is demanded of public servants and candidates for admission into the ranks of the "*Geleherte*," and that such progress has been made in mastering the laws of heredity that it is rare indeed to find a case of reversion to inferior types among the children of the upper classes. Of course I eagerly inquired whether the attempt consciously to comply with the laws of heredity did not seriously impair the spontaneity of domestic and social relations. But though he admitted that there was some temporary disturbance, Mr. Non Nemo stated that the principles had become so indelibly stamped upon society and embalmed in social precedents that the compliance with the necessary regulations had become instinctive and no conscious limitation of social liberty was experienced.

The genial foreigner expressed great surprise at the general neglect of these laws in this country and went into an uncontrollable fit of laughter when he heard of the system of vicarious physical training now in vogue in American colleges. Gladly as we might linger upon these and similar topics the present occasion suggests that we must pass to the more directly scientific aspects of Utopian life.

Some incidental reference to international congresses brought out

[1] *Non* in Utopian nearly corresponds to *Von* in German or *De* in French.

many inquiries on both sides in the course of which the following facts were elicited. In Utopia during recent years the prosecution of science has enormously increased and, as usual, this increase has mirrored itself in the literature. Under the old system, which closely resembled our own, there was neither official supervision nor recognized limitation upon publication. The great mass of literature soon made specialism necessary with constantly narrowing limits, until the broader purposes of scientific study were rapidly being lost sight of in the attempt to meet the bibliographic obligations thus imposed.

Just at this juncture it happened that the continent of South America was opened to the Utopian explorers (whether this occurred before or subsequent to 1492, I was unable to ascertain, by reason of my unfamiliarity with the standards of Utopian chronology). The result was an alarming increase in purely faunal and systematic publications. The case soon became so desperate that a congress of the sciences was called to meet in the capital city which, after mature deliberation, proposed a permanent organization with the following functions and powers.

The organization was called the parliament of philosophy and is a strictly representative body, so guarded that personal jealousy among competitors can not easily exclude worthy applicants, while the financial burdens are nominal.

A council elected at the biennial session of this parliament is charged with the duties of a bibliographic bureau. In this work they receive aid from the department of state corresponding to our patent office and congressional library, here united under one management. At each session committees, appointed by the various sections, report for adoption a scheme of working classification in the department presided over by the section both as relating to the distribution of subordinate topics and the systematic arrangement of the categories of natural species.

While conformity to the scheme adopted is not binding upon authors, it forms a more or less perfect approximation to current views and is the official standard for reference during the ensuing term. This being settled, writers cannot secure recognition for publications until they have been entered in the proper department of the bureau of bibliography, which is also charged with the duty

of distributing a monthly official statement of all titles registered under the proper rubric. The expense of such a record is jointly provided for by the parliament and the general government.

In case a publication contains proposals of new species or new modifications of classification the rules further require that a separate slip bearing the name and a diagnosis in the scientific language of Utopia of each such species or modification proposed accompany the paper. These are entered under the proper head if, after examination by a special committee they are found to conform to the rules of nomenclature adopted by the parliament. If the name be imperfectly formed or duplicated the committee is directed to return to the author for correction.

The name and systematic position of each species is published in the monthly bulletin. At the next biennial session the proper sections of the parliament or committees appointed by them examine the diagnoses of species proposed during the previous term with a view to eliminate any possible synonyms. It is always understood that uncertainty stands to the credit of the proposed species. The work of this committee, my informant said, was found very delicate and there was difficulty in inducing those best qualified to serve. However, its reports are subject to revision in open section meeting and, on the whole, are most useful.

The result, continued my informant, has been to place wholesome restraint upon the professional species-maker as well as to make it possible for all conscientious students to avoid infringement on the rights of others. The fear of the scrutiny of the committee-room acts as a check on careless description, while the biennial reports periodically clears up any ambiguity. Of course there were many who felt themselves aggrieved by arbitrary decisions, but not so many as those who under the old lack of system justly complained of the freaks of fortune and the injustice of powerful rivals. The general opinion seemed to be that, in the long run, every one received a fair measure of justice from this novel parliament.

It also appears that this central organization has depositaries in all the larger cities of Utopia and in the libraries of the various learned societies and that it is becoming quite the thing for every author to send a copy of systematic papers to each of these

depositaries for convenience of examination. Some return is made by the government but just what my informant neglected to state.

I was much interested in Mr. Non Nemo's account of the adjustment of a conflict between local bureaus of research (somewhat like our state geological surveys but with a wider scope), and the official scientific commission of Utopia. This subject, however, we hope to fully elucidate in our contemplated memoir and will simply remark that the adjustment charged the local bureaus with the detailed examinations and collection of material, and imposed the duty of turning over a certain part of the facts and material to the central organization, which reduced the whole to systematic form, and included in its report an epitome of the more detailed publications of the local bureaus.

Several of the provisions described above seem to the writer adapted to the work of the Association for Advancement of Science and later to the International Congress of Sciences and, I trust, we may arrive at a satisfactory system without the long period of experiment and bitterness passed through by science in Utopia.

DESCRIPTION OF A NEW SPECIES OF FIELD-MOUSE (ARVICOLA PALLIDUS) FROM DAKOTA.

BY DR. C. HART MERRIAM.

AMONG some small mammals collected during the past season at Fort Buford, in Northwestern Dakota, by Mr. Vernon Bailey, are four well-prepared skins with skulls of a very light-colored Arvicola, a careful study of which has led to some important and unexpected results. Concerning their habits, Mr. Bailey contributes the following: "The *pallid Arvicolas* seem to be common at Fort Buford. They show a decided preference for the north side of steep hills. I have not found them on the south, southeast, or southwest sides. The only reason I can suggest for this distribution is that the twilight (their favorite hour) is longer

on the north side. The hills where I have found them are all steepest on the north side, which may have some effect, though there seems to be no difference in the vegetation on different sides. Like other Arvicolæ, they have many holes, and probably live in families or colonies, although I have not caught more than one at a group of holes; but from the difficulty in catching them this does not signify anything (have caught only four).

"Where there is grass or weeds, their holes are connected by beaten paths in the same manner as those of *Arvicola austerus*, but in many places they are in bare clay. Their food seems to consist largely of the flowers of certain plants, judging from the remains of flowers scattered around the holes, and from the contents of their stomachs and excrement. When these plants grow near, there are usually pieces of stems and blossoms of *Liatris graminifolia* adn *Artemisia frigida* lying about, but many other plants and grasses seem to be eaten. They feed largely on the seeds of *Eurotia lanata*. I found a place near their holes where something had dug down to a partly-eaten bulb of *Liatris graminifolia*. Probably these bulbs form a part of their diet, as is the case with *Arvicola austerus*. I placed corn, oats, cactus seeds, and seeds of weeds around their holes, but they remained untouched. The same was true of bread and cheese, and fried cake was seldom eaten. They seem suspicious of traps, and evidently leave their holes when traps are set near them. I have caught several grasshopper mice (*Onychomys leucogaster*) and Western white-footed mice (*Hesperomys leucopus sonoriensis*) at their holes, and think these species either drive out the Arvicolæ or else inhabit the old holes." The exact locality where these specimens were obtained, writes Mr. Bailey, "is not actually in the extreme 'bad lands,' but near the edge, where the land is about '*half bad*.' From the fact that they live entirely in the hills and usually near the tops, where it is very dry, it might be inferred that their true home is in the 'bad lands.'"

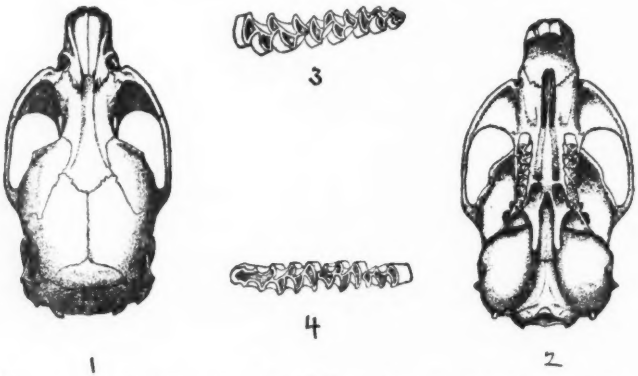
In comparing these mice with the other known North American species of *Arvicola*, two striking external differences are observed, namely, (1) *extreme paleness in coloration*; (2) *extreme shortness of tail*. The color is paler even than that of the Muskeeget Island mouse (*Arvicola breweri*), and the tail is shorter than that of any other species, not excepting *A. pinetorum*, in this respect agreeing closely with *Synaptomys cooperi*. The ears are unusually

prominent, but this peculiarity probably is subgeneric. An examination of the skulls and teeth at once shows the animal to belong to the subgenus *Chilotus* of Baird, to which but one species (*Arvicola oregonus*, from the Pacific coast region) has been heretofore definitely assigned. The range of the subgenus is thus extended more than a thousand miles to the eastward. The present species is nearly as large as *Arvicola riparius*, and consequently considerable larger than *A. oregonus*. Of the four specimens at hand, two are males and two females, all fully adult. The females bear evidence of recent nursing. The species may be easily distinquished by the following diagnosis:

ARVICOLA (CHILOTUS) PALLIDUS sp. nov.

Type no. $\frac{3852}{4431}$, ♀ adult, Merriam Collection. Fort Buford, Dakota, September 10, 1887. Vernon Bailey.

General characters.—Size medium, nearly equalling that of *Arvicola riparius* (average total length of four specimens 126.25 mm.). Tail very short (average length in four specimens 23.75



4431 male *Arvicola* (*Chilotus*) *pallidus* Merriam. From Ft. Buford, Dakota (Type). 1 and 2, skull, double natural size; 3, upper molar series, ×5; 4, lower molar series, ×5.

mm. from actual base; apparent length only about 18 mm.) with a long terminal pencil. Ears medium; thick; well haired, superior border inflexed, giving them a prominence not seen in flat ears of the same size; antitragus medium (smaller than in

A. oregonus), its anterior border becoming continuous with the anterior base of the auricle, thus forming a low rim in front of the meatus as in *A. oregonus* and *Synaptomys cooperi*. Fur everywhere long, full, and soft.

Color.—Upper parts everywhere uniform pale buffy-gray, slightly grizzled by the admixture of black-tipped hairs; under parts white, the plumbeous color of the base showing through in places on the belly; tail more or less obscurely bicolor.

Measurements of four specimens from Fort Buford, Dakota, all adults. Measurements in Millimetres.

No.	Sex.	Measured in the flesh.		Measured from the dry skin.			Date.
		Total length.	Tail to end of vertebræ.	Tail pencil.	Hind foot.	Height of ear from crown.	
31511/41730	♂	124	25	6.5	18.25	5.5	Sept. 8, 1887
31512/41731	♀	121	20	7.5		6.	" 10, "
31513/41732	♂	133	25	8.5	18.7	5.	" 19, "
31514/41733	♀	127	25	7.5	18.	5.5	" 20, "

DR. N. O. HOLST'S STUDIES IN GLACIAL GEOLOGY.

BY DR. JOSUA LINDAHL.

(Continued from July No.)

D. The moraines.—There is a marked difference between the topographical conditions of Sweden and Greenland. The latter country is all mountains. Large flat lands are nowhere to be seen, the mountains rising at once to a great altitude.[1] As a rule one

[1] A. E. Nordenskiöld: Studier och forskningar, föranledda af mina resor i höga norden, Stockholm, 1883. Pp. 63–124.

need not go very far from the coast line to reach an altitude of 1,000 feet, and peaks 3,000 to 4,000 feet high are by no means scarce. As a consequence of this topographic peculiarity the soils are here very different from those in Sweden, and particularly noticeable is the exceedingly thin layer that covers the mopentains. This is true in the same degree as the surface is more or less broken, and it is only in the narrow mountain passes that soil exists to any considerable depth. This is worth noticing in comparison with the well-known fact in Sweden that the outcrops of rock are most abundant where the land is high and broken, the explanation of which seems to be that, in a much-broken tract of ice-covered land, the lower parts of the ice must have but a slight motion, whilst its upper parts meet with but few points for their attacks.

As for the moraines of Greenland, they are essentially only ground-moraines, and inner-moraines, and, as a special form of those, one will also find border-moraines and terminal-moraines. Where the ice runs out to form ice streams, can be observed lateral moraines and, in exceptional cases, middle-moraines; these last two kinds are of minor importance.

The unmixed ground-moraine rarely comes to view, owing to its position beneath the inland-ice and under the other forms of moraines. It may, however, be observed at the side of a jökel-gate (ice-arch) or other cut in the edge of the inland ice, its characteristic features being *rounded and scratched boulders imbedded in a clayey mass of bluish color* due to the presence of iron salts of lower oxidation. It is far more common to find material from a ground-moraine mixed in among inner-moraines. Thus, at Kangarssuk and Arsuk, Dr. Holst found boulders undoubtedly belonging to a ground-moraine scattered among the more sharp-angled material of

[1] These mountains are quite often conical in shape, which has suggested the Danish name "Suckertoppen" to one of the villages of S. Greenland. The Esquimaux often apply to such mountains the name Umanak (from Umat, heart). One island with that name is located off the Arsuk fjord. It is only 600 feet in diameter, but reaches a height of 1,700 feet.

[2] The greatest altitude in Götaland (South Sweden) is found at Pustanäs in Smaland, only 1,237 feet; the highest mountain in Svealand (Central Sweden) is Städjan, 3,961 feet. The highest point in Norrland (North Sweden) is Kebnekaisse, a peak in the extreme north of the Kingdom, with an altitude of 7,194 feet.

an inner-moraine. Such occurrences become gradually more rare as one proceeds further up on the inland-ice and away from land. How the ground-moraine may occasionally form ridges on the top of the ice will be mentioned further on under the heading of *border-moraines.*

The most important moraine is the *inner-moraine.* From its location in the very mass of the ice it will gradually appear on the top as the ice melts away from its surface. It is thus generally found wherever the inland-ice borders upon land, whether this be the nunataks or the coast-lying land. Sometimes it consists of scattered stones and patches of gravel not forming a continuous covering, and then there are generally no considerable moraine deposits on the land adjacent to the ice. At other places it occurs in such abundance as completely to hide the underlying ice, giving the impression of deposits from a departed glacier rather than of a moraine still resting on the top of a glacier.

The greatest inner moraine observed by Dr. Holst was one along the southern edge of Fredrikshaab's ice-blink. It had its eastern limit close to the lake Tasek Atdlek and extended along the southern side of the ice-blink for a distance of nearly twelve miles. Its width, not far from the eastern end, was about half a mile, but the western half of it was more than a mile wide (in one place 8,300 feet), until near the western end it again became narrower. Its thickness is always greatest near land, but here it is often quite difficult to estimate its actual thickness, as it sometimes forms a compact covering, only in some fissures showing the underlying ice. This uneven thickness of the moraine-cover offers to the ice a proportionally varying protection against the sun. It thus happens that the unequal thawing moulds the underlying surface of the ice into valleys and hills, the latter sometimes rising to a height of fifty feet above the adjacent valley, and being so densely covered with moraine material that this completely hides the ice core, which, however, often forms the main part of the hill.

Farther in on the ice, the moraine gradually thins out. At the locality just referred to, the moraine-cover, 3,000 feet from land, measured several inches in depth; still the ice was seen in some bare spots. Beyond 4,000 feet from land, the moraine formed no continuous cover, and at 8,300 feet it ceased entirely, with a per-

ceptible limit against the clear ice. Only some scattered spots of sand and gravel were met with even a few hundred feet farther in on the ice. Dr. Holst estimated the average thickness of the moraine taken across its entire width near its eastern end at one to two feet. The limit between the moraine-cover and the pure ice is always located at a considerable though varying elevation above the edge of the inland-ice. In the instance of the above-mentioned moraine it varied between 200 feet and 500 feet.

The inner-moraine consists of stones, gravel and sand, mixed together. The largest blocks rarely exceed six feet in diameter, whilst by far the greatest number of them are much smaller and of a nearly uniform size. Rounded and scratched stones, derived from a ground-moraine may, in exceptional cases, be found among them, otherwise the material of the inner-moraine is characterized by its angular form, it is equivalent to the s. c. "surface-gravel," "upper boulder-gravel."

There can be but one opinion with regard to the origin of the inner-moraine. When pushing forward over higher ledges the inland-ice disintegrates the rock and carries the débris along. In its further course the ice will for some time retain nearly the same level, and the rock fragments will thus be located *in* the ice, not under it. As the ice melts away above on approaching to land this inner moraine will gradually come to the surface.

It seems proper to apply a special term for those ridge-like moraines which occur on the top of the ice, near land and parallel to it, and are met with especially in places where the land has projecting points which indent the ice; the moraines around the nunataks seem to be partially of the same character. These moraines surround the said points or the nunataks more or less in curves. Being thus confined to the borders of the inland ice they may appropriately be called *border-moraines.*

The border moraines north of the Arsuk fjord ice-river are visible far out on the sea off Ivigtut. Dr. Holst examined one that surrounds the southernmost strip of land at a distance from land of about 2,000 feet. It is not one continuous ridge but consists of several disconnected portions arranged in a semi-circle. One of these portions was about 200 feet wide and thirty-five feet high. This moraine was mainly a ground-moraine, probably forced up by some elevation of the ledge under the ice.

Another border moraine to the north of Kornok's northern ice-river, was of a different character. The stones, at least at the surface, were greatly in preponderance over the gravel. They were angular and of varying size. The moraine showed some arcuations, but taken as a whole it was parallel to the land. In some exceptional instances it approached closely to the land, even so as to touch one of the projecting points, but generally it was located some distance away from land. Its width was estimated at 100 feet, and its height at more than fifty feet; it should be remembered, however, that it might have had a core of ice. Its length was about one and a half mile. South of this moraine, and farther in on the ice, were seen three more moraines, the greatest one extending about 1,000 feet in length. Two of them were parallel, one inside the other.

Every moraine will finally be deposited in front of the glacier, and may then be called *terminal*. This term thus applied would however; be of no value. It is therefore desirable to restrict the sense of the term to such walls or osar as accumulate in front of the ice-rivers proper and generally extend across the valleys in which these rivers find their outlet. Here the moraine material gathers in such quantity and manner as to assume a character different from all other moraines. The great accumulation of material in these places does not depend on the presence of any greater quantity of such material in the ice-river than there is in the balance of the inland ice but rather on the more rapid transposition of material in these rivers.

Terminal moraines are found in front of every ice-river that does not directly run into the sea, *e.g.*, in front of Fredrikshaab's ice-blink and of the ice-rivers at Arsuk fjord and Kipissako, and of the southern ice-river at Kornok. At the last-mentioned place the terminal moraine reached a height of nearly thirty feet and surrounded the edge of the ice like the wall of a fort. At Sarkarigsok, in front of Fredrikshaab's ice-blink, were several walls, one inside the other, each about twenty feet high. The width of the total space covered by these walls aggregated about 450 feet.[3] They extended along the front of the ice-blink, both north and south, as far as the observer could see. The terminal moraines are a mixture of material derived from ground moraines and inner

moraines, sometimes mainly from the former, at other places mainly from the latter, with the addition of material from lateral moraines where such exist. Furthermore, the terminal moraines are often traversed by jökel-rivers and numerous springs which agitate and grind down the contents of the moraine. The merely local occurrence of terminal moraines and the mixed character of its contents, give to it a subordinate importance compared with the ground-moraine and the inner-moraine. Of still less importance are the lateral moraines and the middle-moraines. Of the latter kind none were observed by Dr. Holst. Lateral moraines are met with along the sides of the ice-rivers and at the foot of the nunataks. In the moraines are found some rocks not derived from the neighboring mountains. For this and other reasons, it seems evident that the lateral moraines are not altogether made up of débris from the adjacent sides of the mountains, but have received contributions from inner-moraines, and, in some instances, also from the ground moraine.

Dr. Holst calls particular attention to the fact that in Greenland the blue and the yellow clays are formed simultaneously by the action of the same inland-ice, the former near its bottom where it is protected from the oxidizing influence of the air, the latter nearer its surface; and he regards the bearing of this observation as an argument against the theory, according to which the lower blue clay and the upper yellow clay in Sweden, Denmark, and Germany, are supposed to owe their formation to two different glacial periods.

E. *The upper-drift deposits* are invariably found in process of formation in the larger valleys in front of the ice-rivers, or, in other words, along the greater jökel-rivers. Here they form more or less level plains, through which the river cuts its channel. Equal deposits are also met with in tracts from which the ice has departed, and here too their occurrence is confined mainly to the larger valleys in which once terminated greater or smaller ice rivers with jökel rivers issuing from them. The moraines from which the upper drift derives its material are partially the inner, partially the ground moraine, which first combine to form the

[1] An abundance of Diatoms flourishes in the waters between the terminal moraine and the inland-ice. In one place, at Sarkarigsok, this vegetation displayed a brilliant yellow color.

terminal moraine in front of the ice-rivers, and the material is gradually worked over by the jökel-rivers.

The force of the jökel-rivers is greatest nearest the inland-ice and diminishes as they approach the sea. In consequence, the greatest stones are found near the terminal moraine, whilst further on their size is reduced more and more until all is sand, spreading out to wide sand-plains, as is the case, for instance, off Fredrikshaab's ice-blink. The finest impalpable material is carried out into the fjords and open sea, where it forms deposits of clay.

The upper drift of Greenland shows a considerable resemblance to that of Sweden. Both are free from boulders. The gravel is assorted and stratified. The stones are well ground, although more rounded in Sweden than in Greenland. These deposits in the latter country are not unfrequently of a considerable thickness. In the bottom of the Tasiussak fjord and in a few other places they measured about 100 feet.

There are, however, no typical osar in the part of Greenland visited by Dr. Holst, who found only some smaller hills to a faint degree resembling those formations. There can be no doubt that the osar are formed near and in close relation to an inland-ice. Nothing but such ice could have transported these masses to their present locations, and nothing but the enormous force of the torrents rushing from the ice could have wrought the material so thoroughly. Still it may be less certain that the ose form has been caused in Greenland by the same agencies as those that produced glacial osar in Sweden. It may be a mere accidental resemblance and the form may depend on later excavations. Such osar were formed within the time of the melting of the inland-ice. The coast-land of Greenland presents the same character as Sweden so far that it has formerly been covered with inland-ice which has long ago melted away. Why then is it that typical osar do not exist in the said district of Greenland? Dr. Holst finds the answer to this question in the topographical differences of the two countries. He refers to his earlier discussion of the formation of the glacial osar in Sweden, a summary of which discussion was given at the beginning of this article. As stated there, such osar are formed as sediment in the beds of rivers, having cut their channels into the surface of an inland-ice. The requisite conditions for the formation of large osar

are, among others, first, that the water-divides on the inland-ice shall be sufficiently far apart so that the water supply may be sufficiently great to form larger rivers, and, secondly, that the ice shall be sufficiently free from crevasses, which would otherwise drain off the water beneath the ice instead of on its surface.

It is then evident that, in Sweden, the broad valleys and lowlands with gently rising sides must have offered particularly favorable conditions for the formation of vast gravel-osar, whilst such osar can occur only as local formations of smaller dimensions in the mountain regions of the country. It has long been supposed that gravel-osar were entirely absent from Norway. This is, however, not altogether true, but they are of rare occurrence, which fact fully agrees with the above theory. On the plains of the extreme south of Sweden, as also of Denmark and Germany, the absence of large drainage basins has hindered the formation of greater osar, although they are not altogether absent from Skane, and equivalent formations have been observed by Dr. Holst at Neustadt-Eberswalde. It is equally evident, that the topographical conditions in those parts of southern Greenland above described (page 705) do not admit of any formation of larger osar. In a country so broken and mountainous, the inland ice must be full of cracks, preventing the water from gathering to any great extent over its surface. Such cracks do not necessarily exist in a moving inland ice, and Dr. Holst mentions a smaller tract of ice between Tasek Atdlek and Kangarassuk, which was entirely free from cracks, and, as a consequence, was covered with water, which gathered into a channel five feet wide and five feet deep, in one place separating into two branches, enclosing an island of ice, before it finally rushed into a jökel-well. Also Nordenskiöld and the Danish explorers of the inland-ice met with water flooding its surface.

If the above-given reasons for the absence of gravel-osar from the mountainous part of Greenland are correct, there could have been nothing to prevent such osar from forming in the less broken tracts, f. i. the district of Holsteinborg. Dr. Holst found no opportunity of visiting that district, but after returning home he learnt from A. Kornerup's report of his travels in 1879 (published in 1881) that he had found in the Arsalik valley, N. E. of Holsteinborg, a typical gravel-ose about four miles long, parallel to the

present direction of the motion of the inland-ice, and having a roof-shaped top, and even sides, inclined 20° to 25° to the plane of the valley over which it extended in a meandering course. Mr. Kornerup also states, that the said valley is "an unusually large plain, bounded by even, gently-sloping foothills."

This observation thus fully corroborates Dr. Holst's theory.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

For several years past the Peabody Museum of Archæology and Ethnology, at Cambridge, Mass., has been engaged in the exploration of the remains of the mound builders. More lately, under the direction of the Curator Professor, F. W. Putnam, it has confined its labors to the mounds of Ohio, and especially to those of the Little Miami Valley. A most careful and thorough method of work has been adopted, which has resulted in each mound investigated telling all that it could tell. Some time ago Professor Putnam informed the Bureau of Ethnology of the nature of his work, and requested that they leave him his chosen field, the Little Miami Valley, for his own exploration. This was, of course, an eminently reasonable request. He was first in that field, and had devised his methods of research, while there were thousands of other mounds which were open to other investigators. Besides, in order that the mounds may reveal as much as possible, it is necessary that all in a certain region be investigated by the same hand. With a striking disregard of scientific courtesy the Bureau of Ethnology has this year sent a party into the Little Miami Valley, thus encroaching upon the very territory which was already being explored, and explored—if the testimony of unprejudiced witnesses can be relied upon—in a more thorough manner than is the case with the rapid work of the party under the charge of Professor Cyrus Thomas. Government money should be put to a better use than this.

RECENT LITERATURE.

THE SEVENTH VOLUME OF THE PALÆONTOLOGY OF NEW YORK.—Another of the splendid series of monographs of the Geological Survey of New York has recently appeared, and it certainly is not inferior in interest to any of its predecessors. It contains descriptions of the "Trilobites and other Crustacea of the Oriskany, Upper Helderberg, Hamilton, Portage, Chemung, and Catskill groups, and is notable especially for the elaboration of the species of Phyllocarida, some of which are described for the first time, and many fully illustrated." This has been done by Professor John M. Clarke, to whom the preparation of the volume has been entrusted by Professor Hall. Palæontologists are familiar with the interesting discoveries made by Professor Clarke in this order. Among the more remarkable forms of which we are now afforded excellent byines, are the species of Echinocans, Tropidocans, Rhinocans, and especially the colossal *Mesothyra oceani*. Of Phyllopoda, some interesting forms are described and figured, as well as Cirripedia; while the remainder of the volume is devoted to the molluscs.—*P.*

GOODE'S AMERICAN FISHES.[1]—This is the most comprehensive work which has yet appeared in which North American fishes are described in popular language, "with especial reference," as the title-page informs us, "to habits and methods of capture." The opportunities of its author have been unequalled, since as an officer of the U. S. Fish Commission, and as especially devoted to ichthyological science, he has been for years familiar with its work. Many of the important results of this work are set forth in the book under consideration. These embrace the determination of the nature of the migration, and time and place of breeding of many of the marine species. This subject is in the nature of the case difficult of exploration and elucidation, but a great deal has been accomplished by the Fish Commission in that direction, although much remains to be done. Among the discoveries brought to light by them may be cited the habits of that most valuable fish, the Spanish mackerel (*Scombromorus maculatus* Mitch.), which is in consequence likely to become more abundant in our markets than hitherto, through the protection which can be extended to it on its breeding grounds. The relative importance of the various food fishes is determined not only by their quality and abundance, but by their relation to

[1] American Fishes. A Popular Treatise upon the Game and Food Fishes of North America. By G. Brown Goode, Asst. Sec. Smithsonian Instn. New York: Standard Book Co., 1888, pp. 500.

other fishes, both as food and as enemies. In the former case we find the menhaden (*Brevurtia menhaden*), which, says Mr. Goode, is "by far the most abundant species of fish on the eastern coast of the United States." Millions are captured every year, without any apparent diminution of their numbers resulting. As a raptorial fish, the blue-fish may be cited. The destruction it deals in every direction is thus described by Prof. Baird: "There is no parallel in point of destructiveness to the blue-fish among the marine species of our coast. The blue-fish has been well likened to an animated chopping-machine, the business of which is to cut to pieces and otherwise destroy as many fish as possible in a given length of time. . . . As already referred to, it must be borne in mind that it is not merely the small fry that are thus devoured, and which it is expected will fall a prey to other animals, but that the food of the blue-fish consists very largely of individuals which have already passed a large percentage of the chances against their attaining maturity, many of them, indeed, having arrived at the period of spawning. . . . An allowance of ten fish per day to each blue-fish is not excessive, according to the testimony elicited from the fishermen and substantiated by the stomachs of those examined; this gives ten thousand millions of fish destroyed per day. And as the period of the stay of the blue-fish on the New England coast is at least one hundred and twenty days, we have in round numbers twelve hundred million millions of fish devoured in the course of a season. Again, if each blue-fish, averaging five pounds, devours or destroys even half its own weight of other fish per day (and I am not sure that the estimate of some witnesses of twice this weight is not more nearly correct), we will have during the same period a daily loss of twenty-five hundred million pounds, equal to three hundred thousand millions for the season."

This book gives some means of judging of the utility of the U. S. Fish Commission. As a manual for fishermen it is the best yet published, and with the "Synopsis of Fishes of North America," by Jordan and Gilbert, furnishes an introduction to ichthyology such as few countries possess.

We notice some omissions from the accounts of fresh-water fishes, as, for instance, the omission of notice of the eel, and of commensurate reference to the important food-fishes of the family Catostomidæ. We might point out a few points needing correction, but they are very few, and refer to but one, on p. 15. Dr. Estes writes of the pike-perch (*Stizostedium vitreum* Raf.): "In these waters (Lake Pepin) the wall-eye is seldom found associated with any other fish than the sand-pike. It is true, however, that in swift-rolling waters, especially under falls, we find him in company with the black bass, but I believe that the force of the fall of the tumbling waters in a measure destroy the pugilistic nature of the bass, or he would not suffer

the wall-eye to remain in his company. In other locations the bass easily drives the wall-eye from his feeding grounds." This hardly does justice to the wall-eye. In the Tennessee river and its tributaries the wall-eye is *facile princeps* of the waters, not only from his size and speed, but from his courage. He holds his resting places clear of other fishes, and feeds on the black bass when he approaches too near. I have taken two black bass from the stomach of one wall-eye, of a pound and a half and a pound weight each. The wall-eye is the best food-fish of the Tennessee and its tributaries.

This work is illustrated throughout by excellent process-cuts, of which we present three on the accompanying plate.—*E. D. C.*

RECENT BOOKS AND PAMPHLETS.

Ragonot, E. L.—Diagnoses of North American Phycitidæ and Galleridæ. 1887. From the author.

Martin, D. S.—Christian Evolutionism, and its Influence on Religious Thought. 1887. From the author.

Burmeister, H.—Noticias sobre las Hydromedusæ Argentinæ. Ext. de los Anales de la Sociedad Cientifica Argentina. XXI., p. 5. 1886. —Ueber *Mustela patagonica*.—Ueber *Conurus hilaris*. Wiegman's Archiv. 1879.—Neue Beobachtungen an *Macrauchenia patagonica*. Nova Acta d. Leop.-Carol. Deutsch. Ak. d. Naturf. Bd. XLV.-II. No. 5. 1885. All from the author.

Halsted, B. D.—Bulletin from the State Agricultural College, Ames, Iowa. 1888. From the author.

Fischer, J. G.—Herpetologische Mitteilungen (Kamerun, Angra Pequena, Hayti). 1888. From the author.

Bollman, C. H.—A Preliminary List of the Myriapoda of Arkansas. 1888. From the author.

Clark, W. B.—Ueber die geologischen Verhaltnisse der Gegend Nordwestlich vom Achen-see, etc. Inaugural Thesis for the Degree of Doctor of Philosophy at Munich. 1887.—On Three Geological Excursions made in October and November, 1887, into the Southern Counties of Maryland. Johns Hopkins Univ. Circulars, April, 1888.—A New Ammonite which Throws Additional Light upon the Geological Position of the Alpine Rhaetic. Am. Jour. Sci. 1887. All from the author.

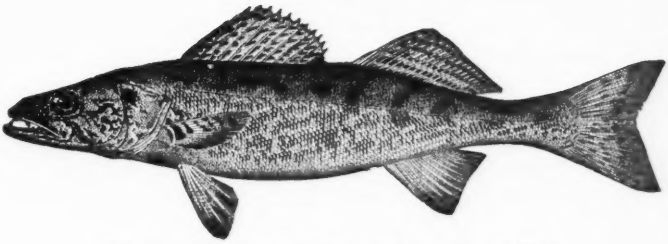
Butler, A. W.—Some Notes on Indiana Amphibians and Reptiles. Ext. Jour. Cin. Soc. Nat. Hist. 1887.

Sclater, P. L.—Report of the Council of the Zoological Society of London for 1887. From the Society.

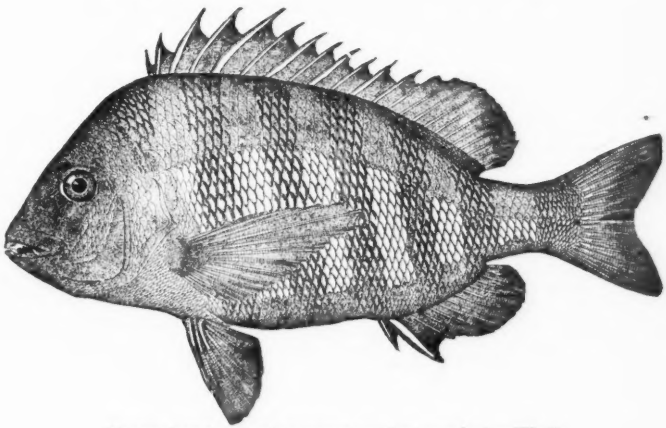
Bather, B. A.—Prof. Blake and Shell-growth in Cephalopoda. Ann. and Mag. Nat. Hist., June, 1888. From the author.

Boulenger, G. A.—On the Herpetology of the Solomon Islands. P. Z. S., Feb., 1888.—First Report on Additions to the Batrachian Collec-

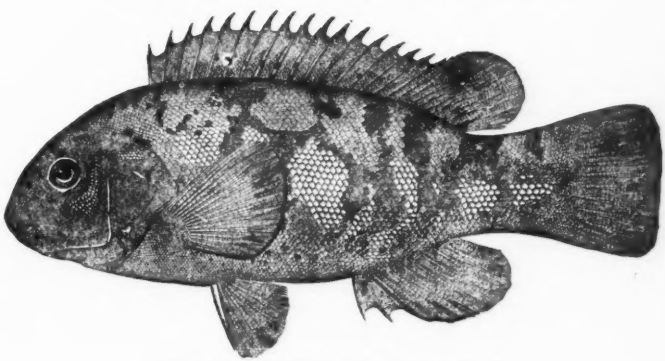
PLATE XIII.



Pike-perch; Walleye; *Stizostedium vitreum* Raf.



Sheepshead; *Archosargus probatocephalus* Walb.



Tautog; blackfish; *Tautoga onitis* L.

tion in the Natural History Museum. P. Z. S., June, 1886.—A List of Batrachians from the Province Santa Catherina, Brazil. Ann. and Mag. Nat. Hist., June, 1888. All from the author.

Lydekker, R.—Note on a New Wealden Iguanodont and other Dinosaurs. Quart. Jour. Geol. Soc., Feb., 1888.

Woodford, A. S.—Note on the Presence of a Columella in the Skull of Ichthyosaurus. P. Z. S., June 29, 1888. From the author.

Shufeldt, R. W.—Observations on the Pterylosis of Certain Picidæ. From the Auk, April, 1888.—On an Old Portrait of Audobon, Painted by Himself. Idem, Oct., 1886. Both from the author.

Woodward, A.—Supplement I. to the Bibliography of the Foraminifera, Recent and Fossil. XIV. Annual Report Geog. and Nat. Hist. Sur. Minnesota. 1885. From the author.

Dames, W.—Die Ganoiden des deutschen Muschelkalks. Palæont. Abhandlungen, IV. Band. From the author.

Bravard, A.—Monografia de los Terrenos Marinos Terciarios de las Cercanias del Parana. Anales del Museo Publico de Buenos Aires. From the author.

Darapsky, L.—Zur Kenntniss chilenischer Zeolithe.—Die Inca-Brucke in der Cordillera von Mendoza Verhand. d. deuts. wissensch. Vereins zu Santiago. 1888. From the author.

Marcou, J.—American Geological Classification and Nomenclature. 1888. From the author.

Newton, E. T.—On the Skull, Brain and Auditory Organ of a New Species of Pterosaurian from the Upper Lias, near Whitby, Yorkshire. Proc. Roy. Soc. Vol. XLIII.

Poulton, E. B.—True Teeth in the Young of *Ornithorhyncus paradoxus*. Proc. Roy. Soc. Vol. XLIII. From the author.

Traquair, R. H.—Notes on Carboniferous Selachii. Proc. Roy. Phys. Soc. Edinburgh. 1887. From the author.

Farlow, W. G.—Vegetable Parasites and Evolution. Address before the Section of Biology, A. A. A. S., New York Meeting, 1887. From the author.

Morse, E. S.—Presidential Address to the A. A. A. S., New York Meeting, 1887. From the author.

Morehead, Mrs. L. M.—A Few Incidents in the Life of Prof. J. P. Espy. 1888. From the author.

Goff, E. S.—The Influence of Atmospheric Pressure upon Percolation. Agricultural Science, Aug., 1887. From the author.

Billings, F. S.—First Report from the Patho-Biological Laboratory Univ. of Nebraska. 1888. From the author.

Ward, L. F.—Asa Gray and Darwinism. 1888. From the author.

Garman, S.—The Rattle of the Rattlesnake. Bull. Mus. Comp. Zool. Harvard, 1888. From the author.

Renard, A.—Note sur les Roches du Pic du Teyde (Teneriffe). Bull. de la Soc. Belge de Geologie, etc. 1888. From the Society.

Hale, H.—The Development of Language. Read before the Canadian Institute, April, 1888. From the author.

Jackson, R. T.—The Development of the Oyster, with Remarks on

Allied Genera. Read before Bost. Soc. Nat. Hist., April, 1888. From the author.

Will, L.—Entwicklungsgeschichte der viviparen Aphiden. Sep-abd. a. d. Zool. Jahrb. 1887.

Viala, P.—The French Viticultural Mission to the United States. Translated by Justina Robinson Hill, with an Introduction by R. T. Hill. 1888.

Eigenmann, Rosa S. } Preliminary Notes on South American nematog-
Eigenmann, C. H. } nathi. Proc. Cal. Acad., July, 1888. From the authors.

Keyes, C. R.—On Some Fossils from the Lower Coal Measures at Des Moines, Iowa. From the Amer. Geol., July, 1888. From the author.

Penna. State College.—Agricultural Experiment Station. Bull. No. 4. 1888.

Selwyn, A. R. C.,
Dawson, G. M.,
McConnell, R. G.,
Tyrrell, J. B., et al. } Geological Report for 1886 of the Geological and Natural History Survey of Canada. Vol. II.

GENERAL NOTES.

GEOGRAPHY AND TRAVEL.[1]

AFRICA.—THE CROSS RIVER.—According to the agreement entered into between Germany and Great Britain, the boundary between the possessions of the former and latter power in the Cameroons district is stated to be the right bank of the Rio del Rey from its mouth (about 8° 40′ E. Long.) to its at present undiscovered source, and thence in a straight line to the rapids upon the Cross River (9° 10′ E. Long). The estuary of the Cross River is well known under the name of the Old Calabar River, and opens into the Bight of Biafra in about 8° 20′—8° 30′ E. Long. The upper part of this estuary is crowded with islands. Into the head of this archipelago Cross River enters after a most circuitous course, the general direction of which is north and south as far as about the sixth parallel north, where it trends eastward to the rapids. The settlement of old Calabar is upon a peninsula on the eastern shore of the Old Calabar estuary, between the Old Calabar and Qua rivers, both of which may be considered as tributaries of Cross River. The Old Calabar estuary is separated from that of the Rio

[1] Edited by W. N. Lockington, Philadelphia, Pa.

del Rey by the Backasey peninsula, the extremity of which is actually an island, since it is cut off from the mainland by the Little Qua River. Mr. H. H. Johnstone, H. B. M. Consul at Old Calabar, has in the early part of this year made a voyage up Cross River for the purpose of making treaties with the various kings and chiefs along its banks, as well as to settle various quarrels that had arisen among the natives themselves, and exercised a prejudicial effect upon the trade of the river. Mr. Johnstone was successful in concluding treaties with Umon (the first country above the Efik or Old Calabar country), Akukuna, and Iko-Morut, and also in inducing the people of those countries to resume friendly relations with each other and with Arun. Above Iko-Morut, and near Atam, the people are inveterate cannibals, and some of them treated their visitors to some startling, though happily bloodless experiences. At a place called Ededema, Mr. Johnstone was dragged out of the canoe by a score of cannibals, mounted on the shoulders of the biggest, and carried off at a run to the town, where he was put in a hut with the door open, and had to bear for an hour the gaze of hundreds of savages. A smoked human ham, hanging from the smoke-blackened rafters of the house, and about a hundred skulls forming a ghastly frieze around the upper part of the clay walls of the hut, served to still further heighten the interest of the situation. Yet as soon as his interpreters rejoined him a friendly conversation was commenced, and the palaver was concluded by the return of the consul to his canoe in the same manner that he had been taken from it. Incidents similar to the above occurred several times as the voyagers proceeded, and since, though all ended in friendship, it was found that at the commencement the savages were undecided whether to look upon their visitor as a supply of food or not, Mr. Johnstone deemed it advisable to return.

The Kaap Goldfields of the Transvaal.—The Kaap goldfields, according to Mr. F. Jeppe, comprise an area of about 800 square miles watered by the Kaap river and its tributaries. To the west this treaty is bounded by the Godwaan-berg or Kaap plateau, to the south by a high range dividing the Kaap from the Moodie goldfields, and to the north by the Crocodile River. Queen's River, the chief source of the Kaap, rises in the southern mountain range, receives the south fork of the Kaap, and then combines with it the Lampogwana or north fork near Eureka City, while the combined stream joins the Crocodile in long. 31° 25′ E., and lat. 25° 32′ S. The terminus of the Lourenço Marques railway will be established upon Transvaal territory at the junction of the Komati and the Crocodile, on the west side of the Lebombo range. The southern mountain range is a huge branch of the Drakensberg, has peaks which rise to 7,600 feet, and forms the water-shed between

the basins of the Komati and Lomati rivers and that of the Kaap and Crocodile. The Lebombo range, which forms the boundary between the Portuguese possessions and the Transvaal, is but a series of low ranges not rising above 900 to 1,000 feet. From the terminus of the Portuguese railway an east and west line is projected across the Transvaal, ascending the Drakensberg, and rising at one point to 5,884 feet. There is abundant evidence that the Kaap valley was extensively worked, centuries ago, by a white race. Quarries, shafts, tunnels, adits, the remains of well-made roads, and pits of ore lying beside them for shipment, are to be found, and it would seem that the works were abandoned precipitately. Mr. Stuart attributes these workings to the Portuguese of the seventeenth century. The valley is not considered healthful, but Barberton, the chief settlement, enjoys a salubrious climate. The lowest strata in the valley are a series of soft gray argillaceous shales, greatly tilted by volcanic action. These seem to correspond with the Silurian, and in the Drakensberg are overlaid by Devonian strata.

KUND AND TAPPENBECK'S EXPEDITION TO THE CAMEROONS.—Among the results of the above expedition are (1), the knowledge that the Beundo and Great Njong rivers have their sources above the cataract region; (2), that the water-parting between the rivers that discharge on the coast, and those that flow into the Congo basin does not lie near the Cameroons coast, as was previously supposed; (3), that the water-parting between the left tributaries of the Binue and the rivers which water the German Cameroons region also lies far into the interior; (4), that the racial parting between the Bantu and Sudan negroes does not lie in the direction of Adamawa, but runs in a southerly direction, and is formed by the Zannaga or Great Njong River, and lies about 145 miles from the coast; and (5), that volcanic formations do not occur in the mountains immediately north of the Zannaga, nor in the region between it and the coast. The Beundo River discharges at Little Batanga, and is known in the interior as the Njong or Nlong, while the Great Njong discharges at Malimba by the Borea and Bornu mouths, and into the Cameroons River by the Quaqua mouth. A profile accompanying the report shows a coast plain about seventy feet above the sea, succeeded by a sharp slope rising to a height of 3,000 to 4,000 feet above sea-level (the Crystal Mountains), beyond which the country slopes gently to about 2,300 feet. Both rivers have a second cataract region in the interior, with a long stretch of navigable water between it and the lower cataracts. The Zannaga no doubt carries off the water of a great river region.

Mossamedes and Benguela.—The bed of the river Giraul at Mossamedes has, according to Mr. E. W. Parsone, for many years been dry, and though pools occur here and there in the interior, and a stream is sometimes formed after heavy rains, no water ever appears on the surface at its mouth. Yet an anchor with a heavy wooden stock has been found embedded in the ancient channel about twenty miles from the mouth. The sandstone cliffs of the coast table-land sink into the valley at about ten miles north of the port, which is larger and has a better depth of water than that of Loanda, from which it is distant 385 miles. The Bero Valley is fertile, and has some low-growing trees, but the rest of the country near the town is barren, and the want of roads and carriers hampers the trade with the interior. Colonies or inland settlements are in full working order at Sa da Bandeira, Huilla and S. Janeira, at altitudes of from 1,500 to 2,000 feet, and at these spots there is abundant agricultural wealth, but no means of reaching a market. The town of Mossamedes is regularly laid out in streets of well-built stone or brick houses, and there is a fine Government House.

Benguella is, after Loanda, the most important commercial place upon the southern part of the West African coast, since its import and export trade is four times that of Mossamedes. The trade with the interior is nearly all done at Catumbella, about twenty miles in the interior, and thus Benguella itself has a suburban appearance, the houses having large grounds, and the streets forming broad, tree-planted avenues. Catumbella and Benguella are connected by telephone, and this instrument is in general use. Carriages, buggies, and bicycles have also penetrated to this African town. A preliminary survey has been made for a railway into the interior, to Caconda, distant about 120 miles from the sea, and thence to Limbigues and Bihe. These highland places are fertile, healthy, and adapted for cattle-breeding. A superior class of rubber gum has been recently introduced by the natives, and, as the caravans, which formerly took nine months to fetch their loads, are now back in three months, it is supposed that a new gum-bearing bush or shrub has been discovered.

America.—Fernando Noronha.—The July number of the Proceedings of the Royal Geographical Society contains a map of Fernando Noronha and its adjacent islands, to illustrate the account of the Rev. T. S. Lea, who was a volunteer companion of Mr. Ridley and Mr. Ramage in their exploration of the little group in 1887. The total length of the group is about six and a quarter geographical miles, and the main island is about a mile and a half in width. The northeast cape of Rat Island is precipitous, but the est slopes to the westward, and is apparently cultivable. The
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mass of the group is volcanic, consisting of basalt and phonolite, but Boobie Island and Egg Island are raised masses of reef rock, which occurs also upon the basalt of Platform Island, and on the southern beach of Rat Island. Mt. St. Michael is a phonolite peak 385 feet high. The Peak (El Pica), is a huge mass of columnar phonolite, with a talus or débris around it. Two other phonolitic masses stand like bastions on the south coast, separated by a ridge of basalt. As the group is surrounded by deep sea, and nothing volcanic occurs near it, Mr. Lea is inclined to think that it marks the site of an isolated vent. The islets of the southern coast are, with one exception, composed of phonolite. Where the phonolite and basalt join, both, especially the former, are more or less disorganized in structure. The Sapate, or southwestern heights of the main island, are basaltic. Three-quarters of the insects taken by the expedition were new to science, and of the three reptiles an amphisbæna and a lizard are peculiar, as are two of the three land-birds. About 200 species of plants were found, some thirty of which were peculiar. Invading plants have mastered the plains, and are gaining the heights and the sea-shore. On the East Hills were found two scrambling bushes of a strange plant which seemed to be the last of their race. Few of the native plants have conspicuous flowers, and many are berry-bearing shrubs, Euphorbiaceae, and grasses. But the flora includes a new dodder, an endemic fig, and two species of Oxalis, also a new Convolvulus. Out of the human population of rather over 2,000, about 1,400 are convicts.

Geographical News.—The census of Paris for 1886 gives a population of 2,260,945, out of whom 1,802,53 are foreigners—nearly eight per cent. As this does not include foreigners passing through Paris, the alien per-centage present at any one moment is really still greater. This foreign population consists chiefly of Belgians, Swiss and Hollanders. The number of births in the city decreases with each successive year. In 1887 the total number of births was 60,666, and the excess over deaths only 5,820.

The population of Melbourne is now estimated at 400,000, or two-fifths of the total population of the colony of Victoria, and one-seventh of that of the whole of Australia.

The Argentine Republic contained in 1887 a population of 3,935,286. Nearly 4,000 miles of railroads are in operation, and the conceded lines extend over nearly one and a half times as much territory.

M. Ant. de Abbadie has found the sources of the river Hawash at the foot of Mount Ilfata, at the end of the Meca range, and on

the summit of Mount Dandi he has found a double lake of considerable extent and depth, shaped like the figure eight. An affluent of the Gudar issues from this lake. He also discovered a deep lake, with most beautiful surroundings, at the foot of the immense crater mountain called Mt. Harro. A stream from this Lake Wancit joins the Walga, which rises on the summit of the mountain.

According to the Consular Report for 1887, the population of Java and Madura in 1886 was 21,997,259, showing an increase of 1,065,605 since 1884. The exports of cinchona are increasing.

Late measurements of the heights of the Austrian Alps have reduced the Marmolata, the highest dolomite, from 11,464 feet to 11,016 feet, have shown the Antelao to have 10,874 feet, and place the Cima di Vezzana at 10,470, and the Cima della Pala at 10,454. The former of these peaks must therefore be regarded as the loftiest of the Primiero group, the remaining peaks of which gain or lose only a few feet by the new survey.

GEOLOGY AND PALÆONTOLOGY.

Osborn on the Mesozoic Mammalia.[1]—In this essay we have a comprehensive and minute study of the Mesozoic Mammalia, based on the existing collections of the world. First among the latter is that of the British Museum; then that of Yale College; then those of Prof. Cope, of the Philadelphia Academy and of William's College, Mass. The results obtained are of the greatest interest and importance to the question of the origin of the Mammalia. Professor Osborn has undoubtedly given the only analysis of the dental characteristics of these types, which we have; and as a consequence we can form a much better idea of their systematic and phylogenetic relations than has been hitherto possible. The results of the research are summarized as follows: First, Traces of Reptilian structure are only observable in the Triassic genera Dromotherium and Microconodon, which Prof. Osborn accordingly places in a new order, the Protodonta. Second, The close parallelism of the American and European genera, and of species of the latter country and South Africa. Third, The diversity of the dental types of the genera, and the specialization of some of them. There are six or seven wholly distinct types of dentition.

[1] The Structure and Classification of the Mesozoic Mammalia. By Prof. H. F. Osborn. From the Journal Academy Natural Sciences of Philadelphia. [2] Vol. IX., pp. 186–265. July, 1888.

Professor Osborn regards the Multituberculata as a distinct series, and considers their reference to the Monotremata to be an open question. Of the remaining types he refers a part to the Marsupialia, under the name Prodidelphia (Hæckel), and the position of the remainder he leaves in doubt, placing them provisionally in the Insectivora. The dental characters of the Multituberculata are tolerably uniform, but the case is different with the two other divisions. In the Prodidelphia there is a carnivorous and omnivorous subgroup, with three well-defined families; and a herbivorous subgroup, including only the remarkable family Kurtodontidæ, based on the single genus Kurtodon, which was discovered by the author himself. Of the possible Insectivora there are two families. The families proposed appear to be well defined.

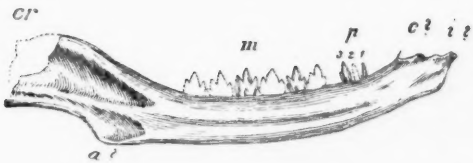
In analyzing the dental characters, Prof. Osborn follows the lines laid down by the author of the present review. He also finds the phylogenetic deductions made by the same author to be sustained by his investigation. Between the simply conic (haplodont) and the complex crown (lophodont) he finds the series to be triconodont, tritubercular, tuberculo-sectorial (lower), and quadritubercular. He confirms the view that the tritubercular has been produced by the rotation outward, in the upper jaw, and inward in the lower jaw of the anterior and posterior cusps of the triconodont crown. Prof. Osborn names the principal cusp the "protocone," and the anterior and posterior cusps "paracone" and "metacone," respectively. Among Mesozoic Mammalia we have the first three of the above types represented, together with a half-prismatic type in Kurtodon Osb., besides the Multituberculata.

This memoir was long in press, and has grown by a process of accretion; hence there appear some unavoidable irregularities of classification of its contents. A foot-note we observe is liable to misconstruction (p. 245), where it states that Dr. Harrison Allen first demonstrated the modification of the tritubercular into the quadritubercular molar crown. Dr. Allen demonstrated the possibility of this history by an acute study of the homologies of the cusps, but he did not demonstrate it ontogenetically or phylogenetically. We have but one serious criticism to make of this memoir. This is the almost universal introduction of specific characters into diagnoses of genera. Examples of this are seen on p. 216, where all the characters in the generic diagnoses except one or two are only specific.

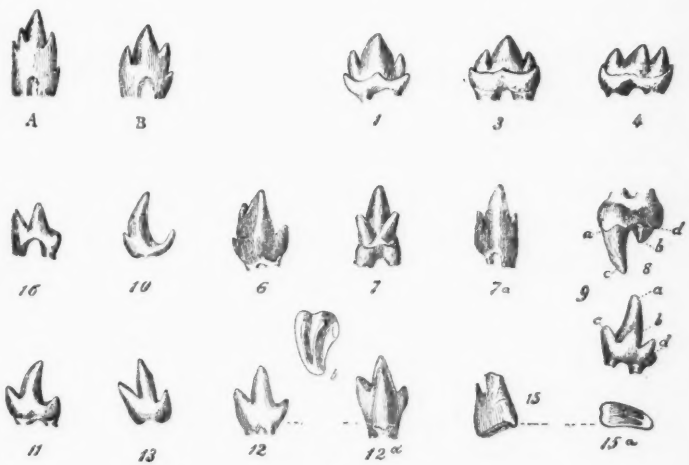
This memoir is illustrated by numerous excellent cuts, and by two plates. Two of the cuts are here reproduced.—*E. D. Cope.*

Lydekker on the Ichthyosauria and Plesiosauria.—In two late numbers of the *Geological Magazine* of London, Mr. Lydekker publishes reviews of the English species of the two

PLATE XIV.



A



B

FIG. A.—*Microconodon tenuirostris* Osborn; outer face of right mandibular ramus, four times natural size.

FIG. B.—Principal molar tooth-forms of the Mesozoic Mammals of the second Group. The anterior face of the molars throughout is to the left, and the posterior face to the right. A, *Dromotherium*, second inferior molar, inner face, × 7. B, *Microconodon*, the fourth lower molar, outer face, × 7. 1, *Amphilestes*, the second lower molar, inner face. 3, *Phascolotherium*, the fifth lower molar, inner face. 4, *Triconodon*, the second lower molar, inner face. 6, *Peramus*, the fourth lower molar, outer face. 7, *Spalacotherium*, third lower molar, inner face. 10, *Leptocladus*, third lower molar, outer face. 11, *Phascolestes*, third lower molar, inner face. 13, *Achyrodon*, fourth lower molar, outer face. 12, *Dryolestes*, lower molar, inner face; *a*, outer face; *b*, wearing surface. 15, *Kurtodon*, upper molar; *a*, wearing surface.

orders above named, which will be of much use to students. He admits three genera of Ichthyosauria, viz.: *Ophthalmosaurus* Seeley (*Baptanodon* Marsh), *Ichthyosaurus* Conyb, and *Mixosaurus* Baur. He does not find any reason to subdivide the genus Ichthyosaurus. Of Plesiosauridæ he admits the genera Plesiosaurus, Thaumatosaurus, Pliosaurus, and Elasmosaurus (under the name Cimoliasaurus), but does not include in the last named the Jurassic species which have the same structure of the shoulder-girdle, which Seeley described under the name of Colymbosaurus several years ago. We find this course inconsistent, and believe the principles adopted by Seeley in his classification of the Plesiosauridæ to be well founded, except as to the genus Murænosaurus, which Mr. Lydekker shows to be a synonym of Colymbosaurus. Mr. Lydekker falls into the error of supposing that the genus Polycotylus is principally characterized by the cupping of the vertebræ. The fact is, that the structure of the paddles is as different from that of Plesiosaurus, as that of Ichthyosaurus is from Mixosaurus, and in much the same way.

Mr. Lydekker in one of th^{e}se papers formulates his reasons for his habitual inconsistency in the matter of taxonomy, by saying that in his opinion generic discriminations are "simply a matter of convenience." We hold a different view, in common, as we believe, with most taxonomists, which we have stated elsewhere. We will content ourselves now with observing that we find the method of Mr. Lydekker a matter of *inconvenience* rather than of convenience. We must also once more protest against being misquoted by Mr. Lydekker. He says (*Geol. Magazine*, Aug., 1888, p. 356), "We may notice Professor Cope's restoration of the so-called *Elasmosaurus platyurus*, given in the *Transac. Amer. Philos. Soc.*, Vol. XIV., pt. i., pl. ii. In this instance the head has been placed at the extremity of the tail," etc., etc. On this I must observe that no such plate appears in the *Transactions of the American Philosophical Society*, or in those of any other Society. Of this Mr. Lydekker can easily satisfy himself. It is true, however, that an error got into the first descriptions of that species (see *Proceed. Boston Society Nat. History*, 1869–70), but it was done in imitation of the precedent laid down by the describer of the species named Cimoliasaurus (a name which Mr. Lydekker wishes to adopt) several years earlier. Here the cervical vertebræ were described as caudals. This mistake was corrected by its author after an inspection of the skeleton of Elasmosaurus. The plates and descriptions published by the American Philosophical Society are also correct, and the genus Elasmosaurus is there for the first time fully characterized. The supposed genus Cimoliasaurus was never characterized by the author of the name.

We suspect that if we were to state that Mr. Lydekker had described the bones of a crocodile as those of an ostrich, and the teeth of a baboon as those of an ape, without at the same time stating that he had himself corrected those errors, he would not consider our method of criticism legitimate.[1] And if we were to assert that in description he called the inside the outside, when he had not done so,[2] and stated that a scientific body had published a plate which it did not publish, he would consider us wanting in a primary essential of criticism, viz., accuracy.—*E. D. Cope.*

BIBLIOGRAPHICAL NOTES ON THE TWO BOOKS OF CONRAD ON TERTIARY SHELLS.—Having had occasion to see various copies of T. A. Conrad's "Fossil Shells of the Tertiary Formations" and "Fossils of the Tertiary Formations," I have found that nearly all of them in some respects are deficient. In fact, I have not seen a single copy that gives perfectly all that has been published in the way in which it had been issued, and one finds in the literature quite a number of assertions which show an erroneous or imperfect knowledge of these two works.[1] For this reason I consider it desirable to give the following notes:—

1. "Fossil Shells of the Tertiary Formations of North America." The two most complete copies which I have seen are those in the library of the Academy of Natural Sciences and my own. Neither is perfectly complete, but both together furnish the following data:—

The book has been issued in two editions, the second edition being a supplement to the first one. The first edition has been issued in four parts.

First edition: Part I. Pages 1 to 20, plates 1 to 6. Yellow cover, with date October 1, 1832. There is nothing printed on the back of this cover.

Part. II. Pages 21 to 28, plates 7 to 14. Yellow cover, with the date December, 1832; a note by the author on its fourth page.

[1] American Naturalist, 1888, p. 165.

[2] We suggest whether Mr. Lydekker has not referred, in the addendum to the V. Vol. Catal. Fossil Mammalia Brit. Mus., a species of Tragulidæ to the Bovidæ and to the genus Tetracerus. We did not allude to this in our review of this volume, thinking the author would correct it himself.

[1] For instance, owing to a deficiency of his copy of the "Fossils of the Tertiary," Professor A. Heilprin says: "Fulgur maximus Conrad, Fossils of the Medial Tertiary Formations, plate 47, not described." (Explorations on the West Coast of Florida, p. 72.) Conrad, however, described this species twice, first on the cover of the second part, then on page 83. Compare also the statements in White's Bibliography of North American Invertebrate Palæontology.

Part III. Pages 29 to 38, plates are mentioned in the text, but none have been published. Yellow cover, with the date August, 1833; on the fourth page there is a note that the plates will be published with No. 4.

Part IV. Pages 39 to 46. No plates. Yellow cover, with date October, 1833; on the fourth page a note signed, "T. A. Conrad, Claiborne, Alabama, November 1, 1833."

Second edition: Pages numbered 29 to 56, plates numbered 15 to 18. One colored geological map of Alabama. Blue cover, the title-page of which gives the date: "Republished with plates, March 1, 1835."

2. "Fossils of the Tertiary Formations of the United States." The book is sometimes quoted as "Fossils of the Medial Tertiary of the United States," on account of the title-page of two of its parts. The following notes are also based on the copy in thelibrary of the Academy of Natural Sciences and my own copy, which supplement each other.

The introduction is numbered V. to XVI.; the rest is numbered 1 to 89. There are forty-nine plates; some of them are without a number. The book has been issued apparently in three parts The cover of the second part contains quite a number of descriptions.

Part I. Pages 1 to 32, plates 1 to 17. The brown cover is without a date, and gives the title: "Fossils of the Medial Tertiary of the United States." The fourth page contains the descriptions of four species.

Part II. Page 33 to 56, plates 18 to 29. The brown cover is also without a date, and on the title-page is also printed, "Fossils of the Medial Tertiary," etc. The other three pages contain quite a number of descriptions, among them the same four species, which are described on the cover of Part I.

Part III. Contains apparently the rest of the book; pages 57 to 89, plates 30 to 49. The brown cover is also without date, but gives the title: "Fossils of the Miocene Formation of the United States."

Regarding the date of issue of the different parts of the "Fossil Shells," and the authorship of Part III. and Part IV., nothing need be said here. Regarding the date of issue of the "Tertiary Fossils," the following may be stated:—

The cover of Part I. of the Academy's copy bears in Conrad's handwriting the date "January, 1838."

The cover of Part II. of my copy is marked with ink in Conrad's handwriting, "May 7, 1840."

The cover of Part III. of my copy is marked in the same way by Conrad, "January 1845."—*Otto Meyer, Ph.D.*

CHALICOTHERIUM AND MACROTHERIUM.—M. Henri Filhol has recently made a discovery of remarkable interest in the beds of Sansan, of the middle Miocene of France. It removes, in the first place, what has long been an enigma, that in three separate miocene deposits, those of Sansan, Eppelsheim and Pikermi, the limbs of one genus are very numerous with no trace of the skull, while the skulls of another genus of about the same size have never been found with the limbs. The discovery that Chalicotherium represents the skull of the long-known skeleton of Macrotherium, the one a supposed ungulate, the other a supposed edentate, is so astonishing that one can hardly credit it at first. M. Filhol himself, however, found the skeleton, which is almost complete, with the skull *in situ*, so that there remains little or no doubt that they belong together, and he now has an extensive memoir in preparation giving the complete characters of the animal. The peculiarity of *Macrotherium* and the more recent *Ancylotherium* is the deep grooving of the terminal phalanges as in the sloths. This, taken with the modification of the middle phalanges and the rotation of the fore and hind feet upon the outer side, with the shortening of the inner toes, is so strikingly edentate, that attention has been entirely drawn away from the upper bones of the hand and foot. When, however, one examines the carpus and tarsus, with the perissodactyl affinities of the molar teeth in mind, it immediately appears that this is a well-marked perissodactylic type, closely resembling that of Palæosyops, in the tarsus, especially. After an examination of the feet in the collection of the Jardin des Plantes, no doubt remained in my mind of the association of Chalicotherium and Macrotherium. Without anticipating M. Filhol's memoir I may note a few of the Perissodactyle characters of the tarsus. The calcaneum has a long neck and broad internal extension, which is lacking in the edentates, for articulation with the astragalus. The latter bone is much like that of some species of *Aphelops* with the neck very short; it has a broad facet for the cuboid. The cuboid has a postero-internal extension which is also found in *Palæosyops*. The cuneiform is very highly modified, being reduced anteriorly to a thin shell. The third metatarsal abuts against the cuboid, the second against the external cuneiform. In short, remove the phalanges, widen the navicular, and lengthen the middle instead of the second metatarsal and you have a true Perissodactyle tarsus. The carpus is equally so, but is much less characteristic. Turning to the skull, we find of course the teeth of the *Palæosyops* type. I think there is an alisphenoid canal. There are other non-perissodactyle characters; there is no third trochanter of the femur and, as M. Filhol points out the arrangement of the skull is very different. The tympanic bones are also largely developed and of a unique shape. The question remains, what is this animal?

M. Filhol's restoration showing the long fore limbs and short hind limbs, and feet resting partly on the side, demonstrates that it had the habits of the sloths. He also informs me that the older individuals retain only one incisor. On the other hand the structure of the carpus, tarsus, skull and teeth, is in so many features so strikingly Perissodactyl, that there seems to be no alternative except to leave *Chalicotherium* in this order and regard it as an aberrant form, with nearest affinities to Palæosyops and genera of that line.—*Henry F. Osborn, Paris, September 1st.*

Geological News.—General.—Mr. Mellard Reade and Mr. Davison have recently pointed out that, owing to the cooling and contraction of the earth, there is at some depth beneath the surface a zone of no stress, that is to say, where the compressive stress due to the radial contraction of the sphere, and the tensile stress due to the circumferential contraction of each zone, are equal. Prof. C. L. Morgan (*Geol. Mag.*, 1888, p. 296) asks, "Is it not possible that throughout the zone of maximum tension, due to circumferential contraction, the rocks may be rendered fluid by relief of pressure?" With regard to mathematical calculations upon the depth of this viscous or fluid zone beneath the surface, Prof. Morgan truly remarks that "numerical calculations in these matters are only too apt to mislead by throwing a glamour of apparent mathematical accuracy over problems concerning which the most noteworthy feature is our profound ignorance."

Cambrian and Silurian.—The Palæontological Department of the Swedish State Museum has published a list of the Cambrian and Lower Silurian faunas of that country, by Prof. G. Lindstrom, and another of the Mesozoic fauna, by Prof. B. Lundgren. The Cambrian is divided into (1) the Eophyton and Fucoid Sandstones, (2) the Paradoxides beds, (3) the Olenus Schists, and (4) the Dictyonema Slate. One hundred and fourteen species are enumerated from this formation. The Lower Silurian comprises 1, Ceratopyge Limestone; 2, Lower Graptolite Schists; 3, Orthoceratite Limestone; 4, Middle Graptolite Schists; 5, Chasmops Limestone; 6, Trinucleus Schists; 7, Brachiopod Schists; 8, Upper Graptolite Schists; and 9x9, Leptæna Limestona. The species enumerated from the Lower Silurian number 627.

Carboniferous.—It appears that the peculiar rock called chert consists mainly of the spicules of sponges. Dr. G. J. Hinde has found it to be thus composed in the Yoredale series of Yorkshire (Eng.), in Wales and in Ireland, while in the June issue of the *Geological Magazine* he describes the character of the sponges of the chert and siliceous schists of Spitzbergen. The Permo-Carbonifer-

ous series of the west and southwest shores of Spitzbergen is over 200 m. in thickness, and is divided by Dr. Nathorst into the Ursa Sandstone, regarded as Devonian, the Cyathophyllum Limestone, the Spirifer Limestone, and the Productus Chert. This series is not followed by grits, sandstones, and coal-measures, but by shales, marls, and sandstones containing an exclusively Permian fauna, and the series itself, though as a whole regarded as stratigraphically equivalent to the Carboniferous Limestone, contains a certain mixture of Permian fossils. The Productus-chert consists of beds of chert composed largely of disintegrated siliceous sponges, but rich also in Producti and other calcareous fossils, and of intercalated siliceous beds consisting of minute grains of quartz, but rich in sponge spicules. The cherty rocks, unlike those of Yorkshire and North Wales, have yielded entire forms of sponges, which have been described by Dr. E. von Dunikowski.

Dr. R. H. Traquair (*Geol. Mag.*, 1888, pp. 251–254) describes three new species of Palæoniscidæ from the English Coal-Measures. The article is the second contribution from Dr. Traquair upon this subject, the first being contained in the December issue of the same magazine for the year 1886.

In the July issue of the *Geological Magazine* Mr. A. C. Seward comes to the support of Prof. Williamson's remark that the specific names and definitions of Calamites are probably worthless, with a figure and description of a specimen which upon one side shows the characters of *C. undulatus*, while the other side of the same cylinder has narrow and equal ribs.

Dr. Schweinfurth has discovered Lower Carboniferous beds in the Arabah valley of Upper Egypt, opening out into the Gulf of Suez. He recognizes the identity of the beds he describes with those of the Wadi Nasb in the Sinaitic Peninsula; the genera are in most cases identical, and the species characteristically Carboniferous.

Mesozoic.—Of the lower portions of the Mesozoic series only the Rhaetic and Liassic strata are developed in Sweden, and not more than twenty-four species are enumerated by Prof. Lundgren from the former and 129 from the latter group. There is then a wide gap in the middle portion of the Mesozoic, until the higher members of the Cretaceous are reached. These are highly fossiliferous, the list comprising 456 species.

Jurassic.—Mr. R. Lydekker (*Geol. Mag.*, 1888, p. 309) restricts the genera of Ichthyopterygia to three, viz.: Ophthalmosaurus, Ichthyosaurus, and Mixosaurus, the last the least specialized. *I*

tenuirostris and its allies are the forms most nearly allied to Mixosaurus Baur, and *I. tenuirostris* has only four digits. From this Mr. Lydekker agrees with Dr. Baur that the Ichthyosaurs have descended from a tetradactylate ancestor. Two additional species, *O. cantabrigensis* and *I. conybeari*, are described, the former from the Greensand of Cambridge (Eng.), the latter from the Lower Lias.

"The Insect-world of the Lithographic Shales of Bavaria" is the title of an extended article in Volume 34 of *Palæontographica*, by P. Oppenheim. Among the fossils described are *Cyrtophyllites rogeri*, a new genus and species of Locustidæ, two new species of Ephemera, *Prolystra lithographica*, *Eucicada microcephala*, *Ischyopteron suprajurense*, n. gen. *et* sp.; Halometra, a new genus of Hydrometridæ, with two species; three species of Carabidæ, a Prodytiscus, two forms of Lamellicornia, two of Clavicornia, three of Sternoxia, one of Rhynchophora, and three of Chrysomelidæ.

CRETACEOUS.—A. S. Woodward (*P. Z. S.*, X. Feb. 21, 1888) shows that the lateral line of *Scyllium sahelalmæ*, from the chalk of Mt. Lebanon, was supported by a series of half-rings, exactly like those met with in Squaloraja and the Chimæroids. The canal of the lateral line was thus presumably an open groove; a condition which obtains in only two living Selachians, Echinorhinus and Chlamydoselachus.

Squatina cranei is the name given by Mr. S. Woodward to a species of "angel-fish" discovered in the chalk of England, and distinguishable from the species of Squatina already satisfactorily known by the great relative size of the spinous dermal tubercles. No defences of this kind have been found in extinct forms, and the existing species has them much smaller in proportion to the size of the fish.

The same geologist also describes certain specimens of mandibles of the singular *Belonostomus cinctus*, revealing the precise character of the dentition, and the relations of the bones. The two rami occupy only half the entire length of the jaw, the anterior half being formed by the enormously elongated pre-symphysial bone. The narrow and deep rami meet at a very acute angle; the symphysis is elongate, gradually diminishing to a thin edge below, and the large pre-symphysial bone, which is a median unpaired element is articulated to the sloping triangular surface thus formed. On the latter bone there is a median row of about thirty large conical teeth, while a great number of smaller similar teeth—the largest little more than one-sixth the height of the largest of the median series—are placed irregularly upon the lateral margins of the bone.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—The sanidinite bombs from San Miguel, one of the Azores group of islands, are regarded by Paun[2] as the first products of the crystallization of the magmas from which the existing phonolitic and trachytic rocks resulted, and not ae altered pieces of some foreign rock caught up by the magma in its passage to the surface of the earth. They are coarsely crystalline aggregates of sanidine, augite, with which are associated other less common minerals, as pyrrhite, azorite and lavenite. The sanidins is intergrown with albeite lamellæ having the position of the dome 13 $P\bar{\infty}$. The hornblende is similar to arfredsonite in composition, and has an extinction of about 34° in plates parallel to the clinopinacoid. The lavenite has all the properties of this mineral as described by other writers.[3] Its extinction on the clinopinacoid is 21°. The little hyacinth-red octahedra of *pyrrhite*, which were regarded by Hubbard as probably belonging to a titanate, were isolated and found to be crystals of a niobate related to pyrochlor or koppite. The *azorite* was analyzed, yielding: $ZrO_2 = 66.3\%$; $SiO_2 = 35.3\%$—very nearly the composition of zircon.—In a brief synopsis of a paper now in course of publication in the *American Geologist*, Mr. Haworth[4] communicates some interesting notes on the Archæan rocks of Missouri. In a diabase porphyrite, from Madison county, are areas of quartz, which seem to be the remains of porphyritic crystals, whose original outlines have been destroyed by the corroding action of the diabase magma before its consolidation. Since an analysis of the rock reveals a content of only 53.4% of silica, it would seem that we have another[5] instance illustrating the possibility of the separation of free silica from a very basic magma. In another porphyrite the rare rock constituent piedmontite was detected. A very instructive fact in connection with the Missouri rocks is the existence of granites of idiomorphic orthoclase crystals which have been enlarged by the addition of orthoclase material. In some cases this enlargement is in the shape of a granophyre border, and in others of a solid vein of irregular outline surrounding a well-marked idiomorphic crystal.—In the course of an examination of a minette from Weiler, near Weiselburg, Alsace, Linck[6] found the porphyritic crystals of biotite to be surrounded

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] Neues Jahrb. f. Minn., 1888, i., p. 117.
[3] Amer. Naturalist, 1887, p. 850.
[4] Johns Hopkins Univ. Circulars, No. 65, April, 1888.
[5] American Naturalist, 1887, p. 372.
[6] Mitth. d. Comm. f. d. Geol. Landesuntere, von Elsass-Lothringen, 1887, i., p. 69.

by the dark zones so characteristic of the mineral in rocks of this class; when treated with hydrochloric acid, the dark color of the external rim was destroyed, leaving an isotropic substance, which the author supposes to be amorphous silica. He explains the origin of the zinc by supposing the biotite to have been acted upon by the remainder of the liquid magma, from which it had separated, and thus to have lost a portion of its alkaline and alkaline-earth constituents, which helped to form the feldspar, forming with small plates of biotite the entire groundmass of the rock. The iron left by this decomposition separated out as magnetite in the dark zinc.—In a late number of the *American Journal of Science* Mr. Kemp[1] describes a dyke of camptonite cutting the rocks in the Forest of Dean magnetite mine in Orange county, N. Y. The rock differs from the typical[2] camptonite in containing a larger proportion of feldspar and smaller crystals of hornblende. The feldspar is an oligoclase with the composition:—

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2	Loss.
48.19	16.79	18.37	6.85	1.32	1.11	5.59	2.31

—While engaged in studying a peridotite from Little Deer Isle, in Maine, Mr. Merrill[3] noticed the enlargement of its augitic constituents by the growth around it of a secondary augite with the same optical orientation, but a different color.

Mineralogical News.—In a very interesting paper on the chemical constitution of the different colored *micas* occurring in a pegmatite at Schüttenhofen, Bohemia, Scharizer[4] records the analyses of several members of the mica group of minerals, and draws some general conclusions in regard to them. The pegmatite is surrounded on all sides by limestone. Its constituents are arranged in three zones, in the first of which *lepidomelane* and white and brown *muscovite* occur. In the second a yellowish white muscovite, and in the third *lithium micas*. Analyses of these are given as follows:—

	Lepidomelane.	Brown Mus.	Yell.-white Mus.	Lithium-mica.[5]
SiO_2	35.31	43.67	44.08	49.26
TiO_2	1.20			
SuO_2	.16			.06
Al_2O_3	22.62	36.69	36.83	25.27
Fe_2O_3	5.68	2.10	.48	
FeO	18.04	.55	.74	.84
MnO	1.19	tr	.25	.85
MgO	3.69			
CaO			1.99	

[1] Amer. Jour. Sci., April, 1888, p. 331.
[2] Ib., III, xvii, p. 147.
[3] Ib., June, 1888, p. 488.
[4] Zeits. f. Krystallographie, 1888, xiii., p. 449.
[5] Cf. Am. Jour. Sci., xxxii., p. 353.

K_2O	8.61		11.10	
$(K.Rb.Cs)_2O$		8.57		13.85
Na_2O	.62	1.95	.21	.35
Li_2O	.30	tr	.37	5.38
H_2O	1.21	4.35	4.98	1.76
Aq	2.30	1.15	1.17	
Fe	.60	.35	.19	5.68

In the discussion which closes the paper Scharizer concludes that all lepidolites are isomorphous mixtures of the pure muscovite molecule with the molecule $(HO.F)_6$. $R^1_8\ Al_6\ Si_{10}\ O_{30}$.—A suite of specimens representing the rarer copper minerals of the Mammoth Mine region in Utah, having come into the possession of Messrs. Hillebrand and Washington,[1] an investigation of their physical and chemical properties was undertaken to determine their true nature. Measurements of the interfacial angles of *olivenite* from the American Eagle mine yielded as the axial ratio for this mineral .9396 : 1 : .6726. It was impossible to determine whether the mineral is orthorhombic or not in consequence of the poor reflections from the $_\infty P\bar{\infty}$ faces. Olivenite from the Mammoth Mine is well crystallized, with a tabular or prismatic habit. The planes most prominent on it are $_\infty P\bar{\infty}$, $_\infty P$, $P\breve{\infty}$, $_\infty P\breve{\infty}$ and $P\bar{\infty}$. Its pleochroism is olive-green parallel to *c*, and brownish yellow parallel to *b*. On small hexagonal crystals of *chalcophyllite* the two new planes $-\frac{1}{2}R$ and $-\frac{1}{6}R$ were noticed. These crystals are tabular in habit, with OP largely developed, and are grouped into little rosettes. *Clinoclasite* occurs both in crystals and in globular and barrel-shaped forms, due to the grouping of crystals in a position varying slightly from parallelism. On the crystals, which are usually elongated in the direction of the *b* axis, the two new forms P and $\frac{1}{3}P$ were detected. Analyses indicate the correctness of the formula usually ascribed to this mineral, viz.: $Cu_3\ (AsO_4)_2 + 3Cu\ (OH)_2$. Two types of *brochantite* (hydrous sulphate of copper) were also examined. Crystals of the first type are dark green, and are prismatic in habit. Those of the second type are of a light green color, and have a curved double-wedge shape, produced by the occurrence of $3\ P\bar{12}$ and $_\infty P\breve{\infty}$ faces. A mineral with the general appearance of *tyrolite* yielded Mr. Hillebrand:—

CuO	ZnO	CaO	MgO	As_2O_5	P_2O_5	H_2O	SO_3
46.38	tr	6.69	.04	26.22	tr	17.57	2.27,

a result indicating a composition corresponding to $5CuO.\ As_2O_5.\ 7\frac{1}{2}H_2O$, instead of to the generally accepted formula, $5CuO.\ As_2O_5.\ 9H_2O$. The mineral forming delicate tufts of silky needles of a light color, supposed by Mr. Pearce[1] to be a new mineral, has been found upon closer examination to have the composition of *Mixite* $(Cu_{20}\ Bi_2\ As_{10}\ H_{44}\ O_{70})$, but different physical properties. It is uni-

[1] Amer. Jour. Sci., xxxv., April, 1888.

axial or orthorhombic, and its specific gravity is 3.79.—According to Prof. Chester,[1] the *marcelite* from Cumberland, R. I., and the photicite and klipsteinite from Jackson county, N. C., are nothing more than mixtures of rhodonite and its decomposition products, a conclusion to which Prof. Bauer,[2] of Marburg, assents.—Native *platinum* and *cinnabar* are reported[4] as occurring in British Columbia. The former has been found in the bed of a branch of the north fork of Similkameen River. It is in the form of rounded grains and pellets. It has the composition:—

Pt	Pd	Rh	Ir	Cu	Fe	Os Ir	Gaugue.
72.07	.19	2.57	1.14	3.39	8.59	10.51	1.69

The rare minerals[4] *uranite, gummite* and *uraconite* have also been found in Canada, at the Villeneuve mica mine, Ottawa county, Province of Quebec.—*Xanthitane*, from Green river, Henderson county, N. C., is an alteration product of sphene. It is apparently a clay with the silica replaced by titanium. The air-dried substance loses 6.02 per cent. of water at 100°. The composition of the dried material is:—

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	CaO	P_2O_5	H_2O
1.76	61.54	17.59	4.46	.90	4.17	9.92

—Bement[5] mentions the occurrence of fine crystals of *wulfenite* at the Red Cloud mine in Arizona, and beautiful *azurite* and *malachite* at Bisbee, in the same State.—Knop[6] declares the olivine from the limestone of Schelinger, in the Kaiserstuhl, to be *forsterite*, with the composition:—

SiO_2	MgO	FeO	MuO	Al_2O_3
41.88	49.83	4.56	1.73	trace

Crystallographic News.—In a very interesting paper recently published, L. Wulff[7] shows that each of the three possible kinds of tetartohedrism probably occurs on crystals of the regular system. The forms derived by the three different kinds of selection can, however, not be distinguished from each other and from some of the hemihedral forms in the same system, except by a combination of morphological and physical observations. By these methods Wulff is lead to conclude that the bromate and chlorate of sodium crystallize in the gyroidal-tetrahedral division, and that the

[1] Neues Jahrb. f. Min., etc. 1888. I., p. 187.
[2] Ib., p. 214
[3] Ann. Rep. Geol. and Nat. Hist. Surv. of Canada in 1886. T. p. 5. Ib. p. 10.
[4] Eakins. Am. J. Science, May, 1888, p. 418.
[5] Zeits. f. Kryst., xiii., 1887, p. 46.
[6] Ib., xiii., 1887, p. 236.
[7] Zeits. f. Kryst., xiii., 1887, p. 273.

nitrates of barium, strontium and lead crystallize in the pentagonal-tetrahedral division of the regular system. Analogous results[1] follow from a discussion of the possible kinds of letartohedrism in the other systems.—Scharizer[2] describes honey-yellow to greenish *xenomite* crystals from a pegmatite vein near Schüttenhofen, Bohemia. The most prominent type is that produced by the combination of the prisms and pyramid with the ditetragonal pyramid, though ricinal planes obscure to some extent the tetragonal symmetry of the mineral. The axial relation is 1 : .62596. In a second type the prismatic faces are wanting.—Wine-yellow crystals of *barite* from the phenolite of Oberschaffhausen, in the Kaiserstuhl, have been examined by Beckenkamp.[3] Three types are recognized. The first is characterized the large development of the prismatic and basal planes, while the second type contains in addition the brachydomes. The third type contains the latter faces developed to the almost complete exclusion of the prismatic faces. The axial ratio of the crystals is .8151 : 1 : 1.3019. They are pleochroic in yellow and white tints.—Cathrein[4] has found in the *adularia* from Schwarzenstein, Zillerthal the prismatic faces $_{\infty}P\frac{9}{5}$, $_{\infty}P\frac{5}{3}$ and $_{\infty}P\frac{7}{2}$, the orthodomes $\frac{8}{7}P\overline{\infty}$ and $-280P\overline{\infty}$, and the orthopyramid $\frac{21}{20}P9$, all of which are new to orthoclase.—Crystals of *chalcopyrite*[5] from Holzheim, in Nassau, are interesting in that they contain the scalenohedron modified only by the very small planes $\frac{P}{2}$ and $2P\infty$.

[1] Ib., xiii., 1888, p. 474.
[2] Ib., xiii., 1887, p. 15.
[3] Zeitschrift, f. Kryst., xiii., 1887, p. 25 and p. 386.
[4] Ib., xiii., 1887, p. 332.
[5] H. Mayer. Ib., xiii., 1887, p. 47.

BOTANY.[1]

THE GENUS TAPHRINA OF TULANE.—This genus (*Exoascus* of Fuckel) of curiously simplified Ascomycetes, is an interesting one for the comparative anatomist, affording as it does such a remarkable instance of structural degradation through parasitism. By Winter (Krypt-Flora v. Deutschland, Oesterreich u. d. Schweiz. 1r Band, 2r Abth., pp. 2–11) the genus was made the principal one of the first order (Gymnoasceæ) of the class Ascomycetes. He divided the Gymnoasceæ into two families, viz.: (1) Exoasci and (2) Gymnoasci, the first including the genus under consideration (under Fuckel's name, Exoascus), and the second, the related genera, Endomyces, Eremascus, Gymnoascus and Ctenomyces.

The extreme simplicity of these plants, composed as they are of little more than single parasitic asci, marks to a great extent their relationship to the larger Ascomycetes. Parasitism has here brought about an almost complete atrophy of the plant body, as in the vine rapes (Rafflesiaceæ), among the parasitic Phanerogams the plant body is almost entirely suppressed, leaving only the large flower bud which grows directly from its hort.

The genus has been recently made the object of study by a Swedish student, C. J. Johanson of Upsala,[2] who has distinguished twenty-one Scandinavian species, as follows:—

Taphrina pruni Tul. (*Exoascus pruni* Fkl.).

T. bullata Tul. (*Exoascus bullatus* Fkl.; *Ascomyces bullatus* Berk.).

T. insititiæ Johans. (*Exoascus insititiæ* Sadebeck).

T. deformans Tul. (*Exoascus deformans* Fkl.; *Ascomyces deformans* Berk.).

T. nana Johans.

T. potentillæ Johans. (*Exoascus deformans* Fkl.; var. *potentillæ* Farl.

T. alnitorqua Tul. (*Ascomyces tosquinetii* Westd.).

T. betulina Rostrup (*Exoascus turgidus* Sadebeck).

T. alpina Johans.

T. borealis Johans.

T. aurea Fries (*Exoascus aureus* Sadebeck; *E. populi* Thüm.).

T. sadebeckii Johans. (*Exoascus flavus* Sadebeck).

T. betulæ Johans. (*Exoascus betulæ* Fkl.; *Ascomyces betulæ* Magnus).

T. rhizophora Johans.

[1] Edited by Prof. Chas. E. Bessey, Lincoln, Neb.

[2] Kong. Vetenskaps-Akademie. Band 13. Afd. III. No. 4.

T. cœrulescens Tul. (*Exoascus cœrulescens* Sadebeck; *Ascomyces cœrulescens* Demoz and Mont.).

T. carpini Johans. (*Exoascus carpini* Rostrup).

T. polyspora Johans. (*Exoascus polysporus* Sorokin?).

T. bacteriosperma Johans.

T. carnea Johans.

T. filicina Rostrup.

T. ulmi Johans. (*Exoascus ulmi* Fkl.).

In an article in the *Annals of Botany* for November, 1887, B. L. Robinson reviews the structure and history of Taphrina, and compiles an annotated catalogue of the North American species, so far as known. According to this article there are eight well-known species, with several others which are less perfectly known, as follows:—

Taphrina pruni Tul., on the fruit of *Prunus domestica* L., forming "the so-called 'plum pockets.'" The Taphrina on *Prunus maritima* Wang., *P. virginiana* L., and *P. serotina* Eber., is considered to be "probably identical."

T. deformans Tul., causing the "peach curl" of the leaves of the peach tree. A Taphrina, probably the same as this, has been found several times in Massachusetts deforming the leaves and branchlets of *Prunus serotina* Eber."

T. purpurascens Robinson (*Ascomyces deformans* Berk. var. *purpurescens* Ellis and Everhart). On leaves of *Rhus copallina* L., causing them to become dark purple in color, wrinkled, limp, and pendent.

T. potentillæ Johnson, on leaves of *Potentilla canadensis* L.

T. flava Farlow, on leaves of *Betula alba*, var. *populifolia* Spach, and also on *Betula papyracea* Ait. "This species must be carefully distinguished from the more recent and very different *Exoascus flavus* of Sadebeck."

T. alnitorqua Tul., "on bracts of the fertile catkins of the alder."

T. aurea Fries. "The only form of this species yet found in America, attacks the fertile catkins of poplar trees (*Populus grandidentata* Michx.).

T. cœrulescens Tul., on the leaves of various species of oaks, producing grayish or bluish spots.—*Charles E. Bessey.*

The Twentieth and Twenty-first Centuries of N. A. Fungi.—In March of the present year these numbers were received by subscribers from the hands of the editors, J. B. Ellis and R. M. Everhart. No change has been made in the style of the work, whose uniform excellence reflects great credit on American botany.

Century XX. contains eight species of Agaricus, three of Boletus, four of Cantharellus, five of Hygrophorus, four of Lenzites,

two of Geaster (the new species described by Morgan in Nov. Am. Nat.), and two of Lycoperdon. The remaining species are for the most part parasitic microfungi.

Century XXI. contains nine species of Agaricus, six of Clavaria, fourteen of Peziza, besides single species of many genera of the larger fungi. The microfungi are also represented by many genera. At the close of the volume, Nos. 2085 to 2100 inclusive are species of Myxomycetes, determined by Dr. Rex and Harold Wingate. The species are (2085) *Physarum cinereum* Batsch, (2086) *P. contextum* Pers., (2087) *Tilmadoche columbina* Berk., (2088) *Stemonites morgani* Pk., (2089) *Didymium eximium* Pk., (2090) *D. fuckelianum* Rfski., (2091) *D. clavus* A. and S., (2092) *Siphoptychium casparyi* Rfski., (2093) *Chondrioderma testaceum* Schrod., (2094) *Comatriche gracilis* Wingate, (2095) *Cribraria intricata* Schrod., (2096) *Tubulina cylindrica* Bull., (2097) *Trichia fragilis* Low., forma *simplex*; (2098) *T. fragilis* Low, forma *botrytis*; (2099) *T. varia* Pers., (2100) *T. scabra* Rfski.

Mr. W. C. Stevenson, Jr., of Philadelphia, has agai nearned the thanks of botanists by making an Index of Habitats for Centuries XI. to XX. of the North American Fungi.—*Charles E. Bessey.*

Allen's Characeæ of America.[1]—As its title indicates, this is the first part of what it is hoped will eventually be a complete monograph of the Characeæ of America. In his introduction the author says that "the demand for information concerning these plants is so pressing that it is thought but to issue the first part of the work now, to be followed in a year or two by the second part, which will contain descriptions of the species now known to inhabit American waters."

The part before us contains (1) an Introduction, mainly devoted to collection, preservation, habitat, etc., (2) a chapter principally consisting of structural details, with a brief historical statement. In this, the term *sporophydium* is introduced for the spore-fruit or sporocarp. We prefer the term *sporocarp*, and regret that our author did not adopt it rather than the other. The term proposed possesses, of course, the advantage of being non-committal as to homologies, but to the present writer it would appear entirely safe to adopt so fitting a term as sporocarp, in place of the vague one of sporophydium (*spora* and *phudion*, diminutive of *phu*, a growth; the term thus signifies a spore growthlet, *i.e.*, a little spore-growth). Following this is (3) a chapter entitled Classification and Synopsis.

[1] *The Characeæ of America.* Part I. Containing the Introduction, Morphology, and Classification. By Timothy Field Allen, M.D., LL.D., Fellow of the New York Academy of Sciences, Corresponding Member of the Buffalo Academy of Natural Sciences, of the Portland Society of Natural History, etc. With fifty-five illustrations. New York, No. 10 East Thirty-sixth street. 1888. 8vo. 64 pp.

This final chapter includes the technical characters of the families and genera represented in America, with synoptical descriptions of the species. The system adopted may be summarily shown as follows:—

CHARACEÆ Richard.

Family I. NITELLÆ u. Leonhardi.
Genus 1. *Nitella* Ag., containing 79 species.
Genus 2. *Tolypella* A. Braun, with 13 species.
Family II. CHARÆ u. Leonhardi.
Genus 3. *Lamprothamnus* A. Braun, containing a single species, presenting three varieties.
Genus 4. *Lychnothamnus* Rupr. u. Leonhardi, with 3 species.
Genus 5. *Chara* Vaill u. Leonhardi, with 62 species, besides many varieties.

The order is thus shown to contain 158 species, of which 58 are given as North American, there being 30 species of Nitella, 8 of Tolypella, and 20 of Chara so recorded.—*Charles E. Bessey.*

ZOOLOGY.

DIRECT NUCLEAR DIVISION IN EUPLOTES.—Dr. K. Mobius describes (*Stzb. Gesellsch. Naturf. Freund*, Berlin, 1887) direct nuclear division in the fission of *Euplotes harpa*. The nucleus elongates transversely, becomes thinner in the middle, and at length divides, the two halves remaining connected by but a thread at the time when the oral cilia of the second individual are formed. Killing with osmic acid and staining with saffranin showed that the chromatin was mostly arranged in thread-like rows of granules and that karyokinetic figures were never formed.

THE FOOT IN PROSOBRANCHIATE MOLLUSCS.—Mr. H. L. Osborn (*Proc. Am. Assoc. Adv. Sci.*, XXXVI.) gives in abstract the results of his researches on the morphology of the foot in the Gasteropods. In Fasciolaria and Fulgur it arises as a paired (not median) elevation of the ectoderm behind the velum and the blastopore. These later coalesce. The conclusions are that this organ must be regarded as ontogenetically, and, possibly, phylogenetically, belonging to the series of paired locomotor organs, like those of annelids and arthropods. To this view, however, the author points out certain difficulties.

THE ELECTRIC LIGHT IN MARINE COLLECTING.—Professor W. A. Herdman communicates to *Nature* an account of experiments made with the electric light in marine collecting, from which we make the following extracts: A sixty-candle power Edison-Swan submarine light was arranged in the mouth of a tow-net, and the whole lowered to a depth of three fathoms and allowed to remain there for half an hour. Another similar net, but without illumination, was lowered on the opposite side of the ship to the same depth and for the same length of time. When hauled to the surface the dark net contained practically nothing, while the other held an abundant gathering, consisting chiefly of Crustacea. Another test was made, both nets being lowered to the bottom (six fathoms), and with similar results. It was noted that the Amphipods taken with the light in the deep net appeared to be mostly red-eyed species. If on detailed examination this is confirmed, it may indicate an interesting relation between the color of the eyes and sensitiveness to the electric light.

THE FAUNA OF THE SUEZ CANAL.—Dr. E. von Martens exhibited at a meeting of the Berlin Gesellschaft Naturforschender Freunde (*Stzber.* 1887) a collection of shells made in the Suez Canal, and made some remarks upon the origin of the fauna of the Canal. Collating all known observations, he found that of twenty-seven species of molluscs found in the Canal, nine came from the Mediterranean and eighteen from the Red Sea. An examination of the fishes showed a similar condition. Of sixteen species reported from the Canal, six were from the Mediterranean and ten from the Red Sea side. The distribution of the species in the different parts of the Canal is shown by tables; and a glance at these clearly indicates that the admixture of faunæ is far from complete.

BRAIN OF CERATODUS.—In a paper (*Proc. Roy. Soc'y.*, XLIII.) Mr. Alfred Sanders concludes that the brain of Ceradotus presents an embryonic condition in three respects, viz.: first, in the extreme size of the ventricles and in the tenuity of the substance of their walls; second, in the alternating origins of the dorsal and ventral roots; third, in the fact that the origins of the dorsal roots are close to the central line. Compared to Protopterus, it differs in the shape and the imperfection of the cerebral lobes, and in the fact of its having a well-developed rhinencephalon; but it agrees in the narrowness of the thalamencephalon and mesencephalon, and in the breadth of the medulla oblongata, as also in the rudimentary character of the cerebellum. Ceratodus agrees also with the ganoids in the comparative narrowness of the mesencephalon and in the proportions of the cerebellum. With the Plagiostomes it agrees in the structure of the optic lobes, both orders presenting a large ganglion

of large cells in the dorsal part. With the Teleostei it agrees in the multi-axial fibres which, a short distance anterior to its termination, resemble Mauthner's fibres, also in the position and fact of their decussation. With Petromyzon it agrees in the structure of the tela choroidea, which covers the fourth ventricle.

Deep Sea Fishes.—Not less than 3800 specimens of deep-sea fishes were dredged in the last voyage of the Talisman. At the dredging No. CX., as many as 931 were captured, of which 780 were *Hymenocephalus italicus* Giglioli.

The truly deep-sea fishes, says M. L. Vaillant, belong to the Elasmobranchiata and to the Teleostei, since the Marsipobranchs do not descend beyond five or six hundred metres. The deep-sea Elasmobranchs yet known are few, and these, singularly enough, are all sharks. That they are very abundant at certain points is proved by the special fishery of Setubal (off the coast of Portugal), and by some individuals taken by the Talisman on the Soudan coast, at depths of from 600 to 1400 metres. Below 500 metres the Acanthopteri become scarce, and such as occur belong for the most part to abnormal types; such as *Melanocetus johnsonii* and the species of Notacanthus. Apodal fishes seem to be more abundant, but the great bulk of the abyssal fishes belong to the Abdominales and to the Anacanthini.

The family Alepocephalidæ, which for a long time contained but a single species, has now six genera, two of them formed to contain species collected by the Talisman, viz.: *Anomalopterus pinguis* and *Leptoderma macrops*. Other new species of this family gathered by the Talisman are: *Alepocephalus macropterus*, *Bathytroctes attritus*, *B. homopterus*, *B. melanocephalus*, and *Xenodermichthys socialis*. These forms, added to those described by Dr. Gunther and others, raise the known species of this family to fifteen. Most of these fishes have the dorsal and anal fins thrown back upon the caudal peduncle, and seem adapted for easy and rapid locomotion.

Among the Anacanthini of the abyssal fauna the Pleuronectidæ are not present. *Pleuronoctes megastoma* was dredged by the Talisman in 560 metres, and this is the greatest depth at which any fish of this family has yet been found. Among the Lycodidæ, *Lycodophis albus* has been found at more than 4000 metres. The Gadidæ themselves have not been dredged at great depths, except the new genus Scopelogadus, which has been taken at 3655 metres.

The absence of Gadidæ from deep-sea dredgings may possibly be accounted for by the superiority of their swimming powers, while, says M. L. Vaillant, the abundance of the Ophidiidæ and Macruridæ may be correlated with the weakness of their caudal peduncle, and the almost complete absence of the caudal fin. The Talisman

dredged the Macruroid *Coryphænoides gigas* at a depth of 4255 metres, and *Alexiterion parfaiti*, nov. gen. and sp. of Ophidiidæ at 5005 m. Among new Ophidiidæ collected by the Talisman are two species of Porogadus and five of Bathyonus. Many of these were taken at 3200 metres.

The abyssal fish fauna seems to be in great part homogeneous. Bathysaurus, Halosaurus, Bathypterois, Macrurus, Coryphænoides, and many other genera are found both in the Atlantic and in the Pacific, and many species seem to have an extensive distribution. Thus *Dicrolene introniger* occurs near the North American coasts and on those of the Soudan; *Macrurus holotrachys* Gunt., discovered at the mouth of the La Plata, has been dredged on the Moroccan coast; *Stomias boa* of the Mediterranean has been taken in the Arctic Ocean, in the Atlantic, and in the Pacific; and the Talisman captured at the Azores, off the Soudan, and at the Cape Verde Islands, a Macrurid which seems to be *Macrurus japonicus* Schleg.

Vacuities in the Skulls of Mammals.—Dr. D. D. Slade presents (*Bulletin Mus. Comp. Zoology*, XIII., 8) a comparative study of certain vacuities found in the macerated mammalian skull. These spaces are due to an arrest of osseous development, and are secondary to the original growth of the bone, but are not to be confounded with air-cells like those of the elephant or as products of absorption. Two types are distinguished: (1) Those that are dependent upon arrested ossification in the body of a bone or at a point where several bones would otherwise come in contact, but neither of which has any special adaption to function; (2) Those that are due to enlarged openings, the result of arrested ossification, which have adaption to special function, and retain this, notwithstanding the modifications which they may have undergone. Examples are described in all of the orders of Mammalia, two plates illustrating the paper.

The Teeth of Sheep.—Miss Florence Mayo has recently investigated (*Bulletin Mus. Comp. Zool.*, xiii.) the question as to whether at any stage of development there occur germs of the superior canines and incisors in the sheep, a question upon which there were conflicting opinions. She finds that at a certain stage in the development of the embryo sheep the dental lamina exists throughout the incisor and canine regions and that in the latter an enamel organ is formed but nowhere is there a dentine germ. No enamel is ever formed and the organ soon disappears. From the standpoint of phylogeny Miss Mayo thinks that the disappearance of the teeth has been a progressive one, beginning with the middle incisors and gradually extending back. This has already been shown by palæontology.

LOCAL VARIATIONS IN THE COLORS OF A FEW NEBRASKA FLYING SQUIRRELS.—Coues and Allen, pp. 656–661, *Monographs of North America Rodentia*, published in 1877, being Vol. XI. of Hayden's Report of the United States Geological Survey of the Territories, state that:

"The American Flying Squirrel, (*Sciuropterus volucella*), presents a range of geographical variation in size quite unparalleled in other members of the *Sciuridæ*, and only equaled in some species of the *Canidæ*, and possibly in *Cervus virginianus*. On the other hand the coloration is remarkably constant, almost exceptionally so. * * * Specimens from the same locality sometimes differ in the color of the dorsal surface as much as do the most diverse examples from widely separated localities."

The local variations in color are well illustrated by five specimens before the writer, viz:—

No.	When collected.	Collector.	Length of body.	Length of tail.	Age.
1	Oct. 26, '85	Miss S. Thom	7.25	5.35	Adult
2	Winter (?), '87	W.B. Harmon	7.00	5.00	Adult
3	Nov. 10, '85	E. E. Good	6.05	5.00	Ad't (?)
4	Nov., '85	J.W.Crabtree	5.20	4.25	Young
5	Winter (?), '87	W.B. Harmon	7.00	5.00	Adult

In numbers one and four the dorsal surface was a dusky brown tinged with fulvous; while the dorsal surface of numbers two and three was nearer a dull yellowish, with a very slight taint of fulvous. The color of the furred membrane of numbers one, two, three and four is of a decidedly blackish cast, deepening near the edges; each specimen being of about the same shade. In each the ventral surface is whitewashed with yellow or fulvous, there being but a slight shade in the washings. Pelage on the ventral surface white to the base.

The upper portion of the tail of numbers one, two, three and four was a dusky yellow color tinged with black, the tail of number two possessing more black than the rest, it being of a darker cast than the dorsal surface of the body. In the case of numbers one and four the dorsal surface of the body possessed more black than the upper surface of the tail, while number three approximated number two. The upper surface of the tail of number two was perceptibly blacker near the distal end. Excepting very slight shades of yellow the under surfaces of the tails of numbers one, two, three and four, were alike; being of a slightly dusky light yellow. Immediately beneath and longitudinally with, the vertebrae of the tails of the four specimens mentioned, was a faint white line. In all the lower surface of the tail is darker and more fulvous than the lower surface of the body; also lighter and much

more yellow than the dorsal surface of the body. In numbers one, two, three and four the eye is encircled by a narrow dusky ring; also in front of this organ is a dusky spot, while the white spot ordinarily found at the base of the ear was almost, if not completely, obsolete.

Number five was a very unusual specimen, both in color and in the arrangement of the color. Mr. W. B. Harmon, who collected this specimen, states that four other squirrels were found in the nest with this one, number two being one. The other two appeared to be similar to number two in color. Besides the measurements already given the description of number five is as follows:

Dorsal surface very light fulvous brown; the color being very regular over the dorsal surface. Below light cream white faintly tinged around the edges with light fulvous brown. Tail above of the same color and shade as the dorsal surface of the body, with edges a shade lighter. The tail below was a shade lighter still and marked by a faint white streak immediately below and longitudinally with the tail vertebræ, and increasing in width and distinctness near the distal end. Pelage on the ventral surface white to the base. The white spot at the base of the ear was quite distinguishable, being about the size of the ear. The narrow dusky ring around and the dusky spot in front of the eye, ordinarily, were obsolete. The pelage on the upper surface of the body was of the same color to the base. The only black or dark hairs visible were the mustaches, which were black. The hair has the appearance of being in a healthy condition, and the specimen is rather above the average size. This specimen is undoubtedly an extreme case of color variation.

Habitat, near Nebraska City, Nebraska, on the Missouri river, in latitude about 40° 30′.

It might be well to notice that the average measurements given in this article are about the same given by Coues and Allen for *S. volucella* var. *hudsonius*, which is stated to exist "mostly north of the parallel of 49°; average measurements of var. *volucella*, the southern variety, being much less.—*W. Edgar Taylor, Nebraska State Normal School, Peru, Nebraska.*

Zoological News.—Sponges.—J. Arthur Thompson describes (*Trans. Roy. Soc., Edin.*, xxxiii.) the structure of the sponge *Suberites somuncula*. The study was rendered difficult from the presence of large numbers of silicious spicules. The ciliated chambers are small, and are in connection with the canal system, the afferent and efferent canals lying side by side. The canal system is of what is known as the fourth degree of complexity. In the same paper are noticed peculiar club-shaped prominences on the surface of Spongelia the function of which is problematical. These knobs

have a well-developed ectoderm, the centre being occupied by a compact and intricate network of fine filaments, the meshes of which were occupied by cells of varied size. Similar structures, it may be noted, occur in several American sponges.

CŒLENTERATA.—G. H. Fowler describes (*Proc. Zool. Soc.*, 1888), a new Pennatula (*P. bellissima*) from the Bahamas. In its systematic position it stands nearest *P. naresii*.

Prof. A. M. Marshall monographs the Pennatulids collected by the "Porcupine" in the *Trans Roy. Soc., Edin.*, xxxiii. Sixteen species are enumerated.

MOLLUSCS.—R. S. Call describes as new (*Proc. Nat. Mus.*, 1887) *Unio ozarkensis* and *U. breviculus* from Missouri.

ECHINODERMATA.—Mr. A. B. Griffiths has proved that the nature of the secretion of the pancreatic follicles of *Uraster rubens* is similar to that of the pancreas of the Vertebrata. The secretion was submitted to a careful chemical and microscopical investigation (*Edin. Roy. Soc. Proc.*, No. 125, p. 120). With a quantity of the secretion uric acid crystals were extracted by methods previously described by the same writer. The pancreatic follicles are borne upon five pairs of tubules, each pair proceeding from one of five radial ducts given off by the pentagonal "pyloric sac" situated on the aboral side of the stomach of the star-fish. The tests showed the entire absence of urea in the secretion, and no guanin or calcium phosphate could be detected.

Researches into the nature of the secretion of the salivary glands of *Sepia officinalis* and *Patella vulgata*, recently carried out by Mr. A. B. Griffiths, prove that these organs have the same physiological function as the salivary glands of the Vertebrata. The cuttle-fish has two pairs of these glands, the secretion of the anterior smaller pair passing directly into the buccal cavity, while that of the posterior larger pair is poured into the œsophagus. The two salivary glands of Patella are situated in front of the pharynx and give off four ducts.

CRUSTACEA.—Richard Rathbun (*Proc. Nat. Mus.*, 1887) adds to our knowledge of American parasitic Copepoda by describing several new species belonging to the genera Trebius, Perrisophus and Lernthropus, from the collection of the U. S. Fish Commission.

According to Mr. A. B. Griffiths, the secretion of the so-called liver of *Carcinus mœnas*, when freshly killed, gives an acid reaction, and its functions are more like those of the pancreas of the Vertebrata than like those of a true liver. The organ consists of two

large glands on each side of the stomach, of a yellow color, and composed of numerous cœcal tubes arranged in tufts.

FISHES.—Dr. H. H. Giglioli, of the Royal Museum of Florence, records (*Nature*, XXXVIII., 103) the receipt of the sixth known specimen of the rare *Lepidosiren paradoxa*, which for many years was only represented by Natterer's original specimens. The present individual was taken at Antaz, near the Madeira River, in September, 1887, and when received was in a state of incipient decomposition. Mr. G. B. Howes communicates a note on the same subject (*l.c.*, p. 126), calling attention to the specimen recorded by Bibron and Milne-Edwards in 1840.

Professor C. T. Lutken has recently (*Vidensk. Selsk. Skr. Kjob.*, IV.) described the skeleton and some other parts of the deep-sea toad-fish Himantolophus. Comparisons are made with Ceratias.

According to Prof. D. S. Jordan and B. W. Evermann, there are about 150 species of fishes known in the waters of Indiana, and about fifty of these may be regarded as food-fishes. Of the remaining kinds, some ten are large enough for food, but for one reason or another are not used. The flesh of the paddle-fish and shovel-nosed sturgeon is poor and tough, that of the garpikes is not eatable, while the hickory shad and skip-jack are valueless on account of their dry thin flesh, full of small bones.

The cisco of the deep lakes of Northern Indiana and Wisconsin, formerly thought by Prof. Jordan to be distinct from the leak herring, and named by him *Argyrosomus sisco*, is now held by, the same authority to be only a local variety of *Coregonus artedi* modified by residence in the smaller lakes.

Prof. W. N. Parker lately read before the Roy. Zool. Soc. a communication on the poison-glands of the genus Trachinus. This paper showed the existence of glands, composed of large granular nucleated cells, continuous with those of the epidermis, in connection with the grooved dorsal and opercular spines of the two British species of the genus.

Dr. A. Gunther (*Ann. and Mag. Nat. Hist.*, June, 1888) describes nine new species of fishes from the Yangtsze-kiang, collected at or near Ichang. One of these, *Eleotris xanthi*, belongs to the spine-finned section, the others are Cyprinidæ or Cobitidina.

M. R. Storms has, in an article in the *Annals and Magazine of Nat. Hist.* for July last, attempted to solve the questions pertaining to the structure and morphology of the disk of the remora. That the disk is a modified spinous dorsal, and not of dermal origin, he believes to be proved: (1), by its position; (2), by the slight transformation of the interneural spines; (3), by the presence of the changed, yet recognizable elements of a normal spinous dorsal fin. A typical segment of the spinous dorsal of Scomber has three

elements: (1), an interneural spine; (2), an intercalary bone (or baseost) which has the shape of two wings; and (3), a spinous ray. A division of the disk of Echeneis has also three elements; the lower extremities of the interneutrals point backwards instead of forwards; the intercalary bone is formed of wing-like plates, and the spinous ray is represented by a pair of pectinated lamellæ joined in the median line and occupying the whole surface of the disk. The upper expanded portions of the interneural spines each carry a pair of lamellæ. The wing-like plates of the intercalary bone are connected by a narrow portion which expands in the middle and rests partly on the interneurals, and the wing-like parts of the consecutive intercalary bones overlap one another like the tiles of a house. The pectinated lamellæ are discovered by M. Storms as transversely enlarged spines, and he believes that the bases of the spines alone have formed the lamellæ, and that the spine proper was gradually reduced until it has nearly disappeared. The rows of small teeth which cover the posterior margins of the lamellæ are by M. Storms thought to be of dermal origin. That they are not formed by outgrowth of the bone is proved by the facility with which they fall off by prolonged maceration. The fossil *Echeneis glaronensis*, the disk of which extends only on to the posterior part of the head, instead of covering its whole surface, seems to support our author's supposition that the disk was originally formed on the dorsal region, and has migrated gradually to its present position.

Reptiles and Batrachia.—Dr. O. P. Hay's list of Amphibia and Reptilia at present known to occur in the State of Indiana includes seventy-seven species, twenty-seven of which are Batrachia.

Dr. A. Günther (*Ann. and Mag. Nat. Hist.*, May, 1888) describes seventeen new species of snakes from tropical Africa, including four of Ahaetulla, five of Boödon, and one each of Causus, Elapsoidea, Simocephalus, Psammophis, Uriechis, Calamelaps, and Elapomorphus, also *Rhinocalamus dimidiatus*, new genus and sp.

Following the above paper Dr. Günther contributes a list of the snakes known from the lake-districts of Central Africa, and shows what is known of their distribution on the east and west coast. The difficulties attending the carriage of natural history specimens in Central Africa is so great, that it is only within the last few years that small collections of snakes have reached Europe. The list contains forty-six distinct forms obtained at Lado, Monbuttee, and Semmio, on the great Central African lakes southward to Lake Nyassa, at the foot of Kilimandjaro, in the Mpwapwa Mountains, and on the highlands of Ugogo. Of these, twenty-two have been found on the West coast, and twenty-five either in the Mozambique or Zanzibar districts of the East coast.

G. A. Boulenger (*Ann. and Mag. Nat. Hist.*, May, 1888) gives the distinguishing characters of the families Pelomedusidæ and Chelydidæ, and states that the former family (though from its structure it must be included in the Pleurodera) differs from the rest of that group in having the neck completely retractile within the shell.

Dr. Paul Sarasin describes the lateral organs of the larva of the Ceylonese cœcilian as related to auditory organs of the invertebrate type.

According to *Nature*, a communication from Mr. George A. Treadwell was read at the meeting of the Zoological Society of London, May 15, containing an account of a fatal case of poisoning from the bite of the Gila monster (*Heloderma suspectum*).

Among a small collection of reptiles and batrachians made at Iguarasse-Pernambuco, Brazil, Mr. C. A. Boulenger reports the occurrence of a new species of Sphærodactylus, two of Hylodes, and one of Nototrema (the marsupial tree-frog). The other known species of the last-named genus are restricted to the Andes, from Central America to Peru.

The same naturalist also describes *Achalinus rufescens*, and *Calamohydrus* (n. g.) *andersonii*, two new species of snakes from Hong-Kong. A specimen of the rare sea-snake *Hydrophis viperina*, Schmidt (*Disteira præscutata* D. and B.) reveals, according to the same naturalist, a new type of dentition, since, instead of a pair of grooved fangs, followed after an interval by a series of smaller solid teeth, as is normal among the Hydrophidæ, it has a series of four equidistant, sub-equal, grooved fangs. *Ogmodon vitianus* Peters, is the only snake previously known to possess a series of grooved fangs.

G. A. Boulenger (*P. Z. S.*, Feb. 7, 1888) describes two new forms of Hoplocephalus from the Solomon Islands, and gives a list of the Reptiles and Batrachia of the group, comprising a crocodile, seventeen lizards, ten ophidians, and thirteen batrachians.

Birds.—Dr. Emin Pasha has recently forwarded to the London Natural History Museum, two collections of birds, the first, comprising 114 forms, from the Wadelai district, between 2° and 5° N. Lat., and 31° and 33° E. Long., while the other, consisting of forty-three species, is from the Tingasi district, westward of 31° E. Long. In the latter collection there is not a single East-African form, while in the former thirty-three forms belonging to the fauna of E. and N. E. Africa occur. It is thus evident that on the western water-shed of the lake-system of Equatorial Africa the Abyssinian fauna disappears and is replaced by the purely tropical features of the West-African river-system. Mr. Thomas attributes the abruptness of the change of fauna, exhibited both by mammals

and birds, to the sudden ending of the great West-African forest. Five previous papers, by Drs. von Pelzeln and Hartlaub, have described former ornithological collections sent to Europe by Emin Pasha, so that it is not to be wondered at that this, the first consignment received at London, contains only four new species.

MAMMALS.—In three papers (*Proc. Amer. Philos. Soc'y*, XXV.) Professor T. B. Stowell describes the glosso-pharyngeal, accessory, and hypoglossal nerves in the domestic cat. Three plates of diagrams illustrate the accounts.

At the meeting of the Royal Society of Edinburgh, May 7, 1888, Dr. Alexander Bruce described a case of absence of the corpus callosum in the human brain.

The skeleton of a second specimen of Swedenborg's whale (*Eubalæna swedenborgii*) has been discovered in Norway. It is said that the original specimen was discovered in the early part of the last century in Gothland, and that the bones were regarded as those of a giant, but that Swedenborg discovered their true nature.

Embryologists will find an account of the ductus endolymphaticus of the ear of the cat, by N. Rüdinger, in the *Sitzungsberichte* of the Munich Academy of Science for 1887. It is illustrated by three plates.

Dr. A. Nehring criticises (*Stz. Gesell. Naturf. Freunde*, Berlin, 1887) Gray's genera of the Fish-Otters. Lutronectes is based on two immature specimens of *Lutra vulgaris* from Japan. The genus Lontra of Gray, characterized by the hairiness of the muzzle, is untenable, because founded on individual variations. Nehring regards *Lontra braziliensis*, *Lutra enhydris*, *L. macrodus*, *L. solitaria*, *L. paranensis*, and *L. platensis* as nothing but local variations of one broad-fronted South American species. *Pteronura sandbachii* of Gray is regarded by Hensel as identical with *Lutra braziliensis* of F. Cuvier. Nehring also states (*l.c.*, p. 66), contrary to Gray and Wallace, that *Canis hodophylax* of Japan is not near to or identical with *C. rutilans* of Sumatra, but rather is to be associated with *C. pallipes* of India.

Mr. A. E. Pratt has obtained an example of the porpoise of the Yangtsze-kiang, which proves to be identical with, or closely allied to, *Delphinus melas* Schlegel.

T. Southwell, F. S. Z., after bringing together all accessible data upon the subject, comes to the conclusion that the European otter breeds in autumn and winter, but more often in the winter.

The collection of mammals recently received by the Natural History Museum of London from Dr. Emin Pasha includes 115 specimens of thirty-nine species. Every specimen is labelled with date, sex, and exact locality, in his own handwriting. Among them

is a chimpanzee, a *Colobus guereza*, two examples of *Galago demidoffi*, the flying squirrel *Anomalurus pusillus* n. sp., and a new coney *Dendrohyrax emini* Thomas. Fourteen of these species have not before been recorded outside of the West-African region, and Emin Pasha has therefore extended their known range a thousand or twelve hundred miles.

ENTOMOLOGY.[1]

A NEW ENTOMOLOGICAL JOURNAL.—The first number of an entomological journal bearing the title *Insect Life* has just been sent out from the Division of Entomology of the United States Department of Agriculture. This journal is "devoted to the economy and life-habits of insects,—especially in their relations to agriculture,—and is edited by the entomologist and his assistants, with the sanction of the Commissioner of Agriculture." We are glad to welcome this periodical, for we believe it will be an exceedingly useful one. As the writer knows from personal experience, a vast amount of interesting matter accumulates in the office of the entomologist, and is buried there simply because the individual items do not seem of sufficient importance to be published in the formal reports of the department. It often happens, also, that results of considerable scientific interest are obtained, the practicable application of which cannot be seen at the time. Naturally, a government entomologist hesitates to publish such results in a report intended primarily for agriculturists. The pages of *Insect Life* will form an appropriate receptacle for all data of this kind. It will, also, enable the entomologist to publish promptly matter of ephemeral interest which would lose its value if kept for the annual report.

The present number contains several articles of considerable interest in addition to a large number of minor notes. We have only a single criticism to offer upon *Insect Life* as represented by the initial number. We regret to see in it an article of the nature of the one entitled *New Species of Oncocnemis*. This article consists of the technical description of five species of moths. In four

[1] This department is edited by Professor J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

cases the description is based upon a single specimen; in the fifth upon but three. The species are from Utah, Colorado, and Nevada county, California. Although the descriptions appear to be very carefully written, and doubtless are excellent ones if it is possible to prepare good descriptions of species from unique examples, still, what is the occasion for publishing these descriptions here? Is it not about time that the serious workers in entomology should abandon the practice of publishing isolated descriptions except where there is a necessity for the description; as, for examples, in articles describing the life-habits of the species in question? We can see the reason for the description of *Lestophomus iceryea*, a parasite of cottony cushion scale which has been artificially introduced into California from Australia.

In form *Insect Life* has the appearance of the bulletins which have been sent out by the Division of Entomology, the size of the page and the type being the same. It is to be published on an average once a month, but will not have the regularity of a regular monthly.

PREVENTION OF CURCULIO INJURY TO CHERRIES BY ARSENICAL POISONS.—During the last two years we have heard it repeatedly asserted by fruit growers that curculio injury can be largely prevented by spraying the trees with Paris green or London purple. At first we were incredulous; but the statement has been made so positively that we have said in reply to inquiries that it might be so but that we could not say in what way the poison acted, as the eggs of the curculio are laid beneath the surface of the fruit and out of the way of anything which might be sprayed upon the tree. We are glad to see that Mr. Clarence M. Weed has begun his work as Entomologist to the Ohio Agriculture Experiment Station by conducting careful experiments on this subject. The results are very striking. They seem to show so far as the results of a single season's work with a single variety of cherries can be relied upon: "That three-fourths of the cherries liable to injury by the plum Curculio can be saved by two or three applications of London purple in a water spray(in the proportion of one ounce to five gallons of water) made soon after the blossoms fall."

Two quarts of cherries from each of the lots experimented on were chemically examined at the time of ripening by Professor H. A. Weber and showed no trace of arsenic.

No explanation is made by Mr. Weed as to the way in which the poison acts. Whether the adult beetles are destroyed before they lay their eggs or whether the poison reaches the young larvæ.

REPORT OF THE U. S. ENTOMOLOGIST.—The annual report of the U. S. Agricultural Department has just come to hand. The report of the Entomologist, although containing less original material than some of the preceding ones, is a valuable one to agriculturists. The principal articles are one upon the Chinch-bug and one upon the Codlin-moth. These were prepared by Mr. Howard, and consist in each case of a résumé of the natural history of the insect and of the more important remedial measures. Although these articles contain little that is new, they will be very useful to agriculturists, as they render accessible information not easily obtained outside of an entomological library. In addition to these two articles the report consists of reports of special agents. The most striking of these is the one by Mr. D. W. Coquillett on *The Gas Treatment for Scale Insects*. One of the principal discoveries made by Mr. Coquillett is that hydrocyanic acid gas when passed through sulphuric acid is rendered harmless to the foliage of trees confined in it. This will greatly lessen the cost and labor of treating trees with this gas. The report is illustrated with figures of portable tents which are used for enclosing the trees while they are being treated.

ANTS AND APHIDS.—In the report of Mr. F. M. Webster[1] as special agent of the Department of Agriculture, we find account of some experiments upon the corn plant-louse (*Rhopalosiphum maidis*). After narrating several experiments clearly showing that the ants collect the plant-lice and carry them to the roots of the corn, Mr. Weber makes the following remarkable statement: "These observations led me to conclude . . . . . Also that ants, of which three species attend these plant-lice, viz., *Lasius flabius, Formica schonfussii, F. fusca,* are not in the least responsible for their distribution over the fields. Although the protection which they offer them greatly increases their number and the amount of injury done in the corn-fields."

We do not think that the conclusions of Professor Forbes[2] can be set aside in this way. We can think of no more interesting subject for study than the working out of the relations which exist between these two kind of insects. Certainly aphids must receive more important results from the development of the highly specialized nectar-secreting apparatus than has been dreamed of till recently.

[1] Report of the Commissioner of Agriculture, 1887, p. 149.
[2] American Naturalist, Vol. xxi., pp 382-579.

EMBRYOLOGY.[1]

Observations on the Development of Cephalopods.[2]—In this memoir Mr. S. Watase deals very fully with the origin of the cells which give rise to the yolk membrane. With the exception of Lankester, all authorities agree in describing the "yolk membrane" as originating from the segmentation of the original germinal disk. As to the origin of the digestive tract, Kölliker and Bruce describe the digestive tract as continuous with the "yolk membrane." Balfour and Lankester derive the "mesenteron" from the lower layer of the mesoderm; Metschinikoff derives the major part of it from the ectoderm, while Ussow traces the whole digestive tract to the ectodermic involutions.

Mr. Watase's conclusions are as follows in regard to these points: (1) The "yolk membrane" is derived from the original germ disk; (2) it makes its appearance underneath the marginal zone of the germ disk, near to the junction of the intermediate zone; (3) the cells of the "yolk membrane" are irregular in outline, fusiform in cross-section, amœboid in movement, each with one or more large nuclei; (4) with the growing edge of the blastoderm the underlying "yolk membrane" keeps pace in growth with the spreading germ disk, but never coming outside of the peripheral zone; (5) the "yolk membrane" grows at the same time from the margin to the centre of the disk, and in time it comes to completely separate the blastodisk from the yolk mass beneath it; (6) the blastodisk at about this stage is a hollow hemisphere placed at one pole of the yolk mass, and with the origin of the "yolk membrane" cells underneath the marginal zone, which grow centripetally underneath the blastodisk, presents a phenomenon comparable in all respects to the epibolic gastrula; (7) hence Mr. Watase believes the "yolk membrane" to be necessarily a true endoderm, and its sole representative in the Cephalopods; (8) as to the origin of the digestive tract, with its appendages, he found it to be formed by the ectodermic invaginations, that is, by prolongations of the proctodæum and stomodæum; (9) at no period of the development does there exist any connection between the "yolk membrane" and the digestive tract, and long before the absorption of the food yolk is completed the permanent digestive canal is formed; (10) with the absorption of the food yolk the "yolk membrane" disappears. The yolk membrane is therefore a provisional structure the function of which

[1] Edited by Prof. John A. Ryder, Univ. of Penna., Philadelphia.

[2] Studies from the Biological Laboratory of Johns Hopkins University. Vol. IV., No. 4, pp. 163–181. June, 1888.

is, like that of the periblast or merocytes in fish ova, for the purpose of appropriating the yolk substance. Two admirably drawn colored plates illustrate Mr. Watase's memoir.

Development of the Sea-Bass (*Serranus atrarius*).—During the early part of the month of July last, in the laboratories of the U. S. Fish Commission, at Wood's Holl, Mass., the writer had the opportunity to study the development of this form. The eggs are of the floating or pelagic type, and very transparent, measuring very nearly 1 millimetre in diameter. The buoyancy of the egg is no doubt increased by the presence of a moderately large oil drop which is embedded in the yolk, near its periphery, and at the pole nearly opposite the point where the blastoderm is formed. Hatching occurs at the end of the third day, and the oil drop is pushed toward the cephalic end of the yolk, as the latter is nearly absorbed.

The embryos when hatched present much the appearance of the young Tautog or Mackerel, as respects their transparency, but they soon have their pigment spots arranged in a peculiar way along the edges of the median fin folds. Later, the arrangement of the pigment cells is somewhat different and more irregular, while a second kind of pale yellow pigment cells appear, forming three pretty well-defined transverse bands, at equidistant intervals, across the body and tail of the young fish.

On the Development of the Calcareous Plates of Asterias,[1] is the title of a beautifully illustrated memoir by J. Walter Fewkes on the later history of the young star-fish, which, together with the memoir by Mr. A. Agassiz, makes our knowledge of the development of these echinoderms very complete. Five fine plates illustrate the paper.

Values in Classification of the Stages of Growth and Decline, with Propositions for a New Nomenclature.—Under this title, Prof. A. Hyatt discusses the values of larval and growth characters, introducing a number of new terms.[2]

[1] Bulletin of the Mus. Comp. Zoology, Harvard College. XVII , No. 1, July, 1888. (Studies from the Newport Marine Laboratory.)

[2] Proc. Boston Society of Nat. History. XXIII., 1888, pp. 396–407.

PHYSIOLOGY.[1]

—Dr. H. P. Bowditch, the President, and Prof. H. N. Martin, the Secretary, of the American Physiological Society, are in Europe for the summer. During the absence of Prof. Martin the duties of the Secretary will be performed by Dr. William H. Welch, of Baltimore.

—The opening of the new Marine Biological Laboratory at Wood's Holl, Mass., is an event of more than ordinary importance to physiologists—not so much for what it now is, as for what it promises to be. At present it is devoted chiefly to the study of morphological problems, owing to the pressing demands from morphologists for opportunities for sea-side work, but even now physiologists find themselves heartily welcomed, and in the numerous problems offered by the muscle and nerve physiology of starfishes, jelly fish, sea-urchins and the like; in the question of phosphorescence; in rudimentary sense organs; in reproduction at its simplest; and in a host of still broader questions concerning the physiology of protoplasm, they will find abundant material for prolonged and absorbing study. The famous zoological station at Naples has lately taken steps toward offering opportunities to physiologists equal to those which it has for years supplied to morphologists; and it cannot be doubted that equally brilliant results will follow and will enrich physiology, as morphology has already been enriched. No special facilities have as yet been provided for physiologists at Wood's Holl, but it is the desire and the intention of the trustees to make the laboratory, in fact as well as in name, a *Biological* laboratory.

—The editor of the *Journal of Morphology* had occasion not long since to defend his action in publishing in his periodical an article of a decidedly physiological character, and his remarks, which we quote from a recent prospectus, of the journal, are noteworthy and suggestive for physiologists generally, as well as for the critics for whom they were written:—

"As long as this remains the only journal in our country that offers to publish zoological papers with adequate illustration, it will be both unnecessary and inexpedient to exclude important papers because they do not happen to be strictly morphological. No such rigid test has ever been applied in a journal of this kind, and a little

[1] This department is edited by Prof. W. T. Sedgwick, of the Massachusetts Institute of Technology, Boston, to whom brief notes, communications, books for review, etc., should be sent.

reflection will show that it is clearly impracticable. Many of our best papers must deal with *mixed* problems pertaining no less—often more—to physiology than to morphology. The end of observation is interpretation, and the goal of all morphology lies in physiology, taken in its broadest and deepest sense. Embryology is one of the leading branches of morphology, and yet many of its more important problems are among the highest known to physiology. These problems are at present inseparably connected with morphological work, and hence cannot properly be excluded from a morphological journal. The same holds true in anatomy and histology; for example, in the case of the sense-organs. The physiological explanation of these organs is what we are all striving for, whether we call ourselves morphologists or physiologists.

"So long as morphologists do most of the work, they will command the field, and their discussions and experimental observations will not be out of place by the side of their morphological studies. The time may come when animal physiology can be separated from animal morphology to the same extent that human physiology is now separable from human anatomy, but we are yet a long way from such conditions. For the present we must recognize the fact, that the relations and bearings of a subject often outweigh the logic of conventional distinctions, and sanction what might be construed, as a violation of the letter, though not the spirit, of our terminology."

The fact is that cellular physiology and what might be called microscopic physiology has been given up of late to a great extent by the strict physiologists, who have turned their attention too exclusively towards the physical, chemical and mechanical sides of the subject. This is particularly manifest in embryology—formerly mainly in the hands of physiologists, now mainly given over to morphologists—and above all in the field of protoplasmic and cellular physiology where the leading names—Flemming, Strasburger, Fol, Bütschli, Carnoy, etc.—are scarcely familiar to the average physiologist. Any one who is acquainted with the brilliant work of the physiologists (Heidenhain, Gaskell, Kühne, etc.) must recognize the extreme value of microscopic physiology and, further, must clearly understand that it means quite as much to physiology as microscopic anatomy does to anatomy. Obviously, to surrender this branch of the science by neglecting or ignoring it is, to say the least, to narrow and restrict the whole subject.

—Some experiments lately made by Mr. C. F. Hodge,[1] under the direction of Dr. H. H. Donaldson, at the Johns Hopkins Uni-

[1] Am. Journ. of Psychology, Balt., May, 1888.

versity, may serve to illustrate the importance and the fruitfulness of the methods of microscopic physiology.

Starting from the well-known facts of gland histology and physiology where it has been now for long known that activity and rest produce corresponding visible changes in their contents, etc., the authors sought to ascertain whether some discoverable change in the active (or worked) nerve cell could not also be distinguished.

Hodge reports as a result, that a marked shrinkage of the nucleus occurs in worked nerve cells over those not worked; a shrinkage amounting sometimes to 33 per cent. In brief:—

"1. The nucleus and cell body both decrease in size as a result of stimulation.

"2. The protoplasm of the cell becomes vacuolated as a result of stimulation.

"3. Differences appear in staining."

SCIENTIFIC NEWS.

—Professor A. H. Tuttle, of the Ohio State University, has been elected to the chair of Biology and Agriculture in the University of Virginia.

—Professor Herman L. Fairchild, of New York city, has been elected Professor of Natural History in Rochester University.

—Otto Burbach, known through his investigations of the Foraminifera of Lias, died at Gotha, April 22, 1888.

—Dr. Richard Blochmann has been elected ordinary Professor of Zoology in the University of Königsberg.

—Mr. F. H. Herrick, who has been for several years pursuing post-graduate studies at the Johns Hopkins University, has been elected Professor of Biology at Adelbert College, Cleveland, Ohio.

—The work of the U. S. Fish Commission at Wood's Holl this summer is confined almost exclusively to affording facilities for students to investigate the life-histories of marine animals. The laboratory is under the immediate charge of Dr. John A. Ryder, while among those working there may be mentioned professors and students from Harvard, Johns Hopkins, Princeton, and two Ohio colleges.

—James Stevenson, of the United States Geological Survey, died July 25th. Mr. Stevenson was born in Maysville, Ky. He was the business manager in the field of the U. S. Geological Survey under Dr. F. V. Hayden during its existence, and contributed greatly to the efficiency of its work. He was also a very important agent in securing from Congress the appropriations necessary to its success. His large acquaintance in Congress was always most valuable to the scientific enterprises of the Government departments. He is one of the few persons who ascended the great Teton. He was especially interested in American Ethnology, and made extensive collections in that department. The Report of the Secretary of the Smithsonian Institution for 1881 contains an important report by him. He was also a zoologist of considerable attainments.

—Silas Stearns was born in Bath, Maine, May 13, 1859, and died in Asheville, N. C., August 2, 1888. His early education was received in the schools of Bath.

In 1878 Mr. Stearns visited the Smithsonian Institution, where, by his thorough and exact knowledge of the habits of the fishes of the Gulf, and of their economic value, he attracted the special attention of Professor Baird, Mr. Goode, Mr. Bean and others interested in the study of fishes. Mr. Stearns was strongly attracted towards a naturalist's life. His ambition, however, met with discouragement in the absurd statement made by some one in Washington to the effect that no successful work in science would be possible without a classical education.

In 1880 he was made a special agent of the U. S. Fish Commission and the U. S. Census Bureau, in charge of investigations of the marine industries of the Gulf of Mexico. Few pieces of work have been performed with more accuracy and fidelity than his report to the Census Bureau.

An intimate friend says of him: "To my mind his most striking characteristic was patient persistence. No trouble was too great, no time too long, no discomfort too annoying to deter him from the present accomplishment of any task to which he addressed himself."

Few men engaged in business pursuits have been of such substantial aid to science as Silas Stearns, and few have had so many warm and devoted friends among scientific men.—*D. S. Jordan.*

—Seth Green, the famous pisciculturist and Superintendent of the New York State Fishery Commission, died at his home here at one o'clock August 20th, after a long and painful illness. He was born at Rochester, New York, on the 19th of March, 1817. He began fishing as a business when eighteen years of age. He confined himself principally to the waters of Lakes Ontario and Mich-

igan, and availed himself of all the devices then known for catching fish for market. In 1864 he purchased a portion of Caledonia Creek, and began his remarkable system of artificial propagation. This event in his life, so important to all lovers of fish, both for sport and table, has an interest which is intensified by Mr. Green's own modest account:—

"I first conceived the idea of fish-hatching in 1837 while fishing for brook trout in a stream that was frequented by salmon in Canada. I observed some salmon at work making their nests preparatory to casting their spawn. I watched their operations for two days, and then and there made up my mind that I would hatch fish artificially, and would at some future day attempt it. At this time I had never heard of fish being hatched artificially. I kept the idea constantly before my mind, and took advantage of every opportunity to learn something in regard to it. I did not put my ideas into practice until the year 1864, and as brook trout offered the best inducements, I commenced my operations with them, in which I was very successful, making many heretofore unknown improvements and discoveries in fish culture, one of the most prominent being the discovery of the dry method of impregnation of spawn, which I made the first month I was in the business after the spawning season commenced. In the year 1867 the New England Fish Commission, hearing of my success, came to me and prevailed upon me to go to the Connecticut river and attempt the artificial propagation of shad. Many had tried before and failed. After many vexations and trials, among which was the disbelief and scepticism of the fishermen, with which I had to contend, they believing that I was insane, and treating me as such, and after the failure of numerous experiments, I at last hit upon a plan which has proved a great success, and is now, and will continue to be, the means of replenishing our shad rivers equal to the best they have ever been known."

A Fishery Commission was appointed in New York State in 1868, and Mr. Green was made one of the three Commissioners. Two years afterwards he resigned his position and became Superintendent of the Commission, which owns a hatchery at Caledonia and another at Cold Spring Harbor. The sole ambition of his life, as he himself expressed it, was to make good fish abundant. This in a certain measure he succeeded in doing, and he was everywhere regarded as a benefactor to the poor, the rich, and especially to the sportsman.

—Close to the U.S. Fish Commission station at Wood's Holl, Mass., is the new building of the Marine Biological Laboratory, which was

opened July 10th, as already noticed in these pages. The building is a large but plain two-story structure, noticeable for the number and size of the windows. The ground floor is devoted to elementary zoological instruction. In one corner a small room, partitioned off from the rest, affords a study for the instructor, Mr. B. H. Van Vleck, while all of the rest of the space is occupied by students' tables, aquaria, etc. The upper floor, the arrangement of which is essentially the same, is devoted to investigators, and is under the charge of Dr. C. O. Whitman, who is the director of the laboratory. Various circumstances rendered it impossible to send out the circulars for the laboratory until so late a date that but few could avail themselves of its facilities. There are the present season about a dozen students, equally divided between the two rooms. Notwithstanding the haste with which the building was gotten ready for occupancy it has a fair equipment of all necessary reagents and apparatus. Flowing fresh and salt water are furnished from the pumps of the Fish Commission, but the iron pipes which carry the latter will have to be replaced with some other material on account of rust. The directors have solved the problem of board by opening a boarding house in a cottage (the use of which is given the laboratory by Mr. Fay) where good table board is furnished for $5.00 per week. The property of the laboratory now amounts to nearly $10,000, but it needs several thousand dollars more before it can be placed in the position it ought to occupy.

PALANOC, ISLAND OF MASBATE, PHILIPPINES,
April 29th, 1888.

EDITORS OF THE AMERICAN NATURALIST:—I herewith forward you a third instalment of narrative of our trip to the Philippines, which I shall be glad to have published in the AMERICAN NATURALIST, if you think best. We have now been in the islands eight months, and have three remaining; have visited and made representative collections on eleven of the larger islands of the group, and have four still remaining to visit. We have made large collections in most branches of animal life, and have much which from the data we have in hand appears to be new. We shall be able to make a very good comparative study of the islands from our collection. We are already able to say that the islands can be divided into at least five very distinct areas —that of the west including Paraqua and Balabac; that of the south including Mindanao and Basilan; that of the centre including the the large islands of Panay, Negrus, Cebu and Bohol; that of the west including Samar and Leite, and that of the north of Luzon and adjacent islands. Whether the great island of Min-

doro stands by itself we have yet to discover. Each of these divisions has its own peculiar species of such test families as the hornbills, woodpeckers, tailor-birds, sun-birds, pittas, and king-fishers, and in many cases several peculiar species of each.

Yours truly,

J. B. STEERE.

—EDITORS NATURALIST:—Not long since I passed a day at Ward and Howell's Natural History establishment at Rochester, and I was so much interested and surprised, that I have thought that some of the readers of the NATURALIST would be glad to know more of this, the most extensive establishment of its kind in the world. I had bought several thousand dollars worth of specimens of various kinds from Ward and Howell in fitting up the museum of the School of Mines and I had found it a great help to be able to obtain at a fair price authentic, reliable material needed to illustrate lectures upon geology and natural history, and not to be procured through any other channel. But until I stopped at Rochester and went through the establishment, I had no conception of the great variety and excellence of the material available for science teaching that was here accessible with the growing interest in scientific studies, and the increasing appreciation of the value of object teaching, that man is a public benefactor who will supply to us at a reasonable cost, all things necessary to illustrate lessons and lectures. This, Ward and Howell can do to a greater degree than any one person, firm or company in the world. This statement may be regarded as an exaggeration, but after considerable experience with the dealers in natural history material abroad, I do not hesitate to repeat it with emphasis. Professor Ward is himself an educated, scientific man, well up in geology, mineralogy and zoology; he also has a passion for adventure and collecting, which has carried him more nearly "all over the world" than any one else of whom I have known or heard. After his stock of the more common things was large enough, he gave himself up for years to the search of rarities. For example, some years since an interest was excited in the structure of *Hatteria*, and many biologists desired to study its pineal eye and other matters connected with its anatomy, but none were to be had; so Professor Ward, as he has often done, organized an expedition to find and obtain the desideratum. In this case it was necessary to search for long distances along the coast of New Zealand before the haunt of this peculiar lizard was reached, and a sufficient number was captured to supply the wants of the museums of Europe and America.

He and his assistants have scoured India, Borneo, Africa and South America for rarities and always with a degree of thoroughness and intelligence that secured success. Recently, when a good

skeleton and skin of the dugong was needed for the Melbourne Museum, it was found more convenient to get it from Professor Ward than to depend upon the efforts of Australian hunters or naturalists.

Ward and Howell have been now for years occupied in efforts to secure the best representatives of all departments of zoology, and in some instances have undertaken to do what no other dealers in scientific material have the resources and intelligence to attempt, namely, the fitting up of complete museums like that presented by Mr. Brooks to the University of Virginia, and the systematic series of Mammalia gathered for the Museum of Comparative Zoology at Cambridge, and the collection of monkeys presented to the American Museum of Natural History by Mr. Jessup.

Professor Ward's interest in his business and his enthusiasm has always outrun his judgment, until he finds himself with a mass of scientific material in quality, quantity and variety beyond the paying demand. No museum in this country has anything like such a display of interesting specimens in all departments of natural science as Ward and Howell have, while the quantity stored in cellars, tanks, store houses, is much greater. It is in fact a liberal education in natural history to go carefully through their establishment.

This includes, first, rooms devoted to minerals, gems and ores, objects with which Professor Ward began, and which have always held a warm place in his heart. Here the display is very fine, finer indeed than in any public or private collection on this side of the Atlantic. Second, the building devoted to geology containing rocks and fossils from various parts of the world. Third, the department of vertebrate zoology, in which are to be found some living animals of special interest but many more in pickle, skeletonized or stuffed. Fourth, the department of invertebrate zoology, which includes a splendid collection of shells, and a collection of sponges exceeding in volume and interest any other known to me. Fifth, the botanical department, which includes the herbarium of the famous Dr. Harvey.

Among the living animals I was especially interested in a group of about two dozen individuals of *Heloderma* (The "Gila monster") which Professor Ward has had under observation and from which he has learned much that is new in reference to their habits.

In the preceding paragraphs I have spoken simply of Professor Ward or of Ward and Howell, it is but just, however, to Mr. E. E. Howell, to say that he is much more than a mere name in the establishment. He is a trained geologist and was for a long time connected with the United States Geological Survey. Naturally, he presides over the departments of geology and mineralogy; his special interest which is also shared by Professor Ward is meteor-

ites, and it has led them to make extraordinary efforts to gather these interesting objects. Efforts which have resulted in by far the finest collection in this country.

To those who know little of Ward and Howell they may seem mere traders, and this letter, a puff of a business house, but they are much more than traders, they are co-laborers in the work of scientific education whose assistance many a teacher has recognized with gratitude; and this letter is an unsolicited appeal to all those interested in the natural sciences to visit an establishment where so much may be learned at so little cost; and to call attention to the vast amount of indispensable material for the museum, the lecture room and the laboratory which Ward and Howell have brought within easy reach and much of which, without their efforts would have been entirely unattainable.

Yours truly,
J. S. NEWBERRY.

—In the AMERICAN NATURALIST for June, 1888, vol xxii., page 537, appeared an article on "The relative weight of the brain to the body in birds," by Dr. Joseph L. Hancock, which it seems, by an oversight of the publishers, failed to bear his name, making it necessary to call attention to the omission.